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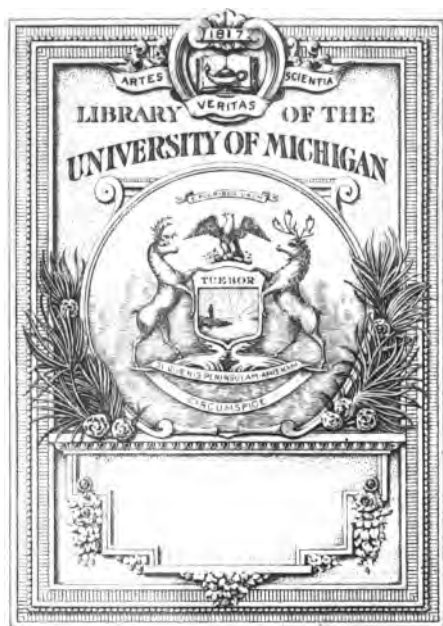
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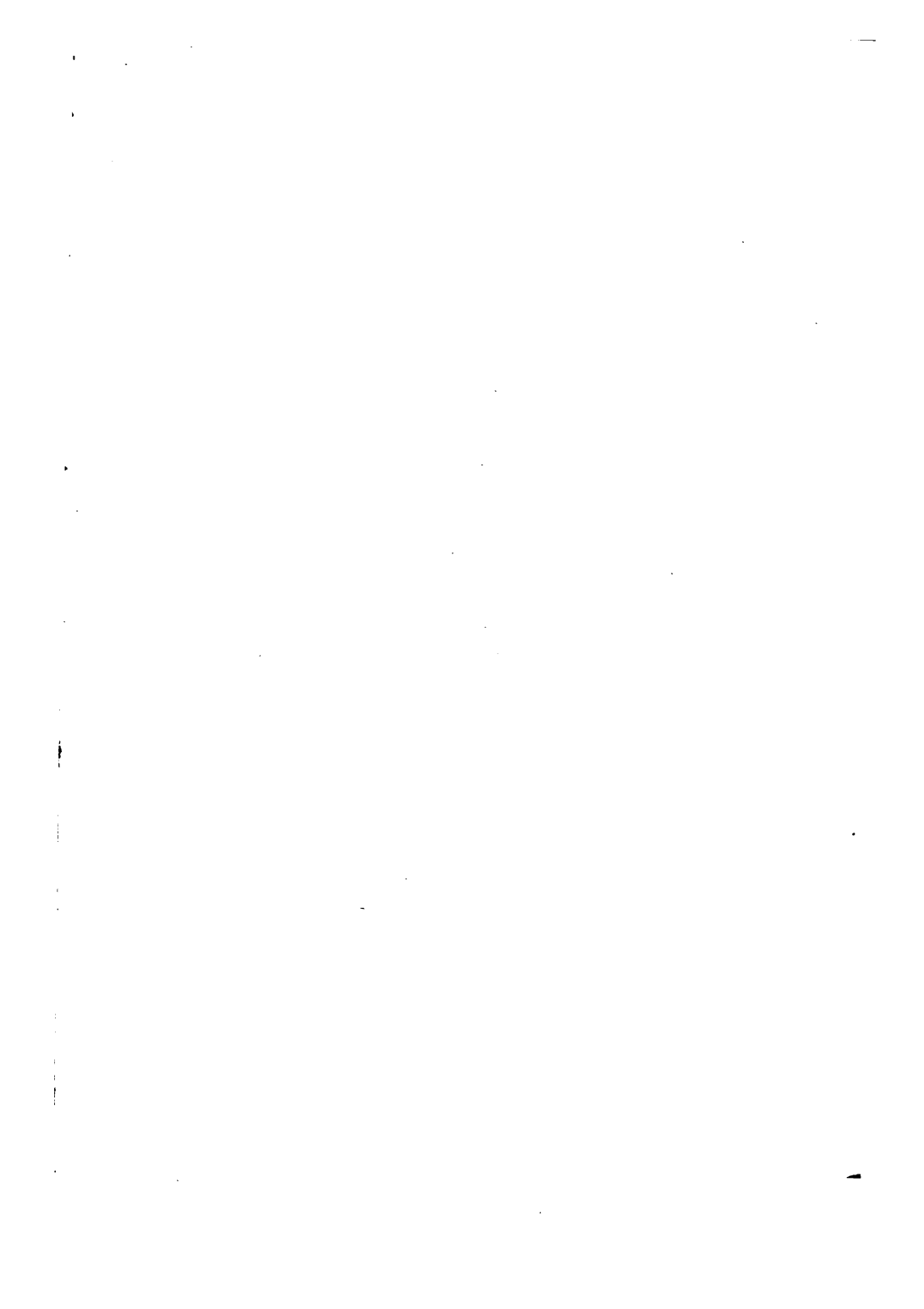
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State Capitol, Madison, Wis.

INDUSTRIAL GEOGRAPHY OF WISCONSIN

BY
JAMES A. MERRILL, S. B.

TEACHER OF GEOGRAPHY AND GEOLOGY, STATE NORMAL SCHOOL,
SUPERIOR, WISCONSIN



1912 .

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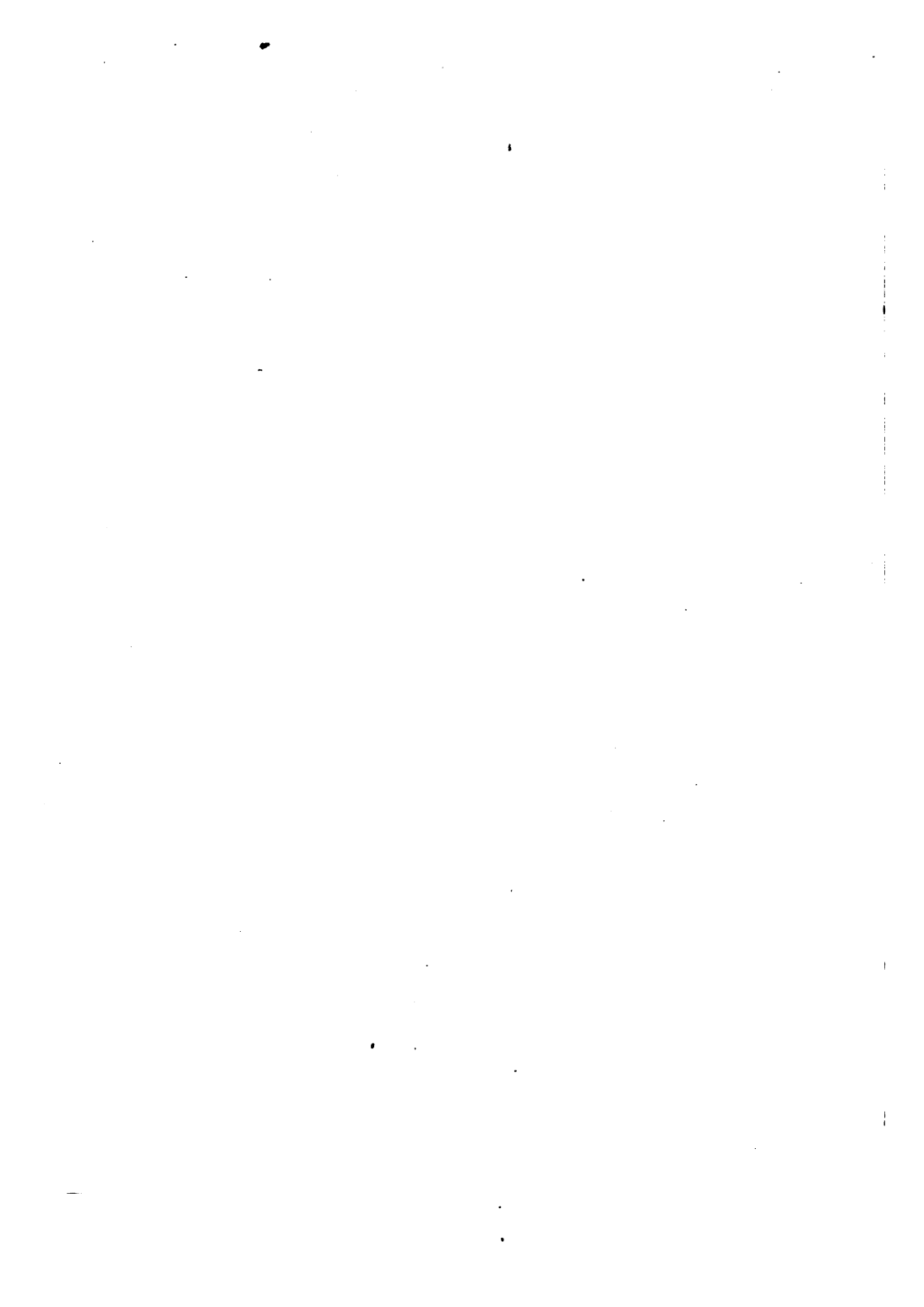
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TABLE OF CONTENTS.

	PAGE
PREFACE	7
INTRODUCTION	9
I GEOGRAPHY IN THE SCHOOL ROOM	13
II THE BUILDING OF LAND MASSES.	19
III THE BUILDING OF WISCONSIN	25
IV THE WORK OF GLACIERS.....	31
V WISCONSIN WEATHER.....	44
VI CLIMATE OF WISCONSIN.....	49
VII DRAINAGE OF WISCONSIN	54
VIII WATER POWERS OF WISCONSIN	64
IX SOILS AND GROUND WATER	75
X MINES AND MINERALS OF WISCONSIN	82
XI INDUSTRIAL DEVELOPMENT OF WISCONSIN	91
XII PRINCIPAL INDUSTRIES OF WISCONSIN.....	99
XIII TRANSPORTATION.....	127
XIV PRINCIPAL INDUSTRIAL CENTERS	137
XV IMPORTANT EVENTS IN WISCONSIN HISTORY	156
XVI STATE EDUCATION	161
XVII CO-OPERATION OF THE STATE AND THE CITIZEN.....	166



PREFACE.

There is little known by the general public about the great natural resources of the State of Wisconsin. The literature of the subject, which is considerable, has been contributed largely by experts in the reports of geological surveys, bureaus and societies of various kinds, including the statistics of the state and national census, and the publications of the State Agricultural College and the University. This material is very valuable and thoroughly reliable, but it is not within reach of the general reader or the pupils of the public schools.

In this little book the author has brought together considerable information that has been gathered from all available sources and has endeavored to arrange and combine the facts in such a way as to make them of value to students of the upper grades and to general readers.

Many people and many authors have rendered assistance in the preparation of the book. Special mention is due to the writings of Reuben Gold Twaites, Prof. E. C. Case and Dr. Samuel Weidman. The manuscript was read in whole or in part by Dr. Samuel Weidman, of the State Natural History Survey; Mr. H. W. Richardson, U. S. Weather Bureau; Mr. Frank Leverett, U. S. Geological Survey; Prof. C. J. Brewer, Superintendent of Schools, New Richmond, Wis.; Supt. E. W. Maddock, of the Superior Public Schools; Hon. C. H. Crownhart, of Superior, and Miss Susan W. Norton, Critic Teacher of the Grammar grades in the Superior Normal School. Many helpful suggestions were made by these and others who were

consulted about different phases of the work as the preparation of the manuscript proceeded.

The illustrations are generally credited to the sources from which they came. Many of the maps and diagrams were made by former students of the Superior Normal School, whose faithful work is here acknowledged. Thanks are also due to the University of Wisconsin and the Agricultural College for photographs illustrating the different phases of their work, and to the many business men and manufacturers who have generously furnished information and illustrative material in many different parts of the book.

JAMES A. MERRILL.

Superior, Wisconsin,
October 12, 1910.

INTRODUCTION.

To the Boys and Girls of Wisconsin:

The object of this little book is to tell you some useful things about the great state in which we live. We all know something about the land and the people that immediately surround us, and we want to extend this knowledge to other parts which we have not seen.

What is Geography? We must not get the idea that geography is a study of far-away places only. Every day we see how people are furnished with clothing, food and shelter, and the work of furnishing these things constitutes the principal occupations of men in all parts of the world. All of these things come from the soil, either directly or indirectly, and, therefore, the tilling of the soil, the manufacture of products of the soil and the transportation to and from the factory are some of the most important lines of industry. The result of all this producing, manufacturing and furnishing needed materials to the consumer is trade and commerce, the principles that underlie these industries are geographic principles, and the influences that change and control them are geographic influences. Geography is the study of geographic principles, influences and facts as they relate to the comfort, happiness and progress of man in all parts of the world.

The State of Wisconsin. Our state is only a small portion of the United States. It is surrounded principally by the waters of the Great Lakes and the Mississippi river, but has a land boundary of Illinois on the south, a small part of Minnesota on the west and of Michigan on the northeast. Its total area is 56,040 square miles, but, since

the boundary lines are partly in the middle of the Great Lakes, it has a water surface of 1,590 square miles, while the remainder is land.

These are useful facts about Wisconsin, but they are not the most important facts. Our state has great natural resources of surface, soil and water power, and is favored by a climate that gives it great advantages in the production of the necessities of life. No area of land of equal size in the world has more varied geographical advantages than Wisconsin, and no equal area has greater possibilities of natural wealth among all its citizens.

Location. Wisconsin is one of the north boundary states of our country. It occupies the half-way point between the Equator and the North Pole, since the parallel of 45° runs through it and since in it lies the Meridian of 90° W., it is half way between Greenwich (London) and the International Date Line in the Pacific ocean, which marks the beginning of the day. The exact location is between $42^{\circ} 30'$ and $47^{\circ} 3'$ north latitude and between $86^{\circ} 49'$ and $92^{\circ} 54'$ west longitude. In the same latitude are found southern France, Switzerland, Austria-Hungary, northern China, Oregon and North Dakota; in the same longitude are found Hudson Bay, Louisiana and Galapagos Islands. Thus Wisconsin has a favorable location for the production of the necessities of life and for transporting them east and west to the centers of dense population.

Boundaries. The boundaries of Wisconsin as fixed by Congress are Minnesota, Lake Superior and Michigan on the north, Michigan and Lake Michigan on the east, Illinois on the south, and Iowa and Minnesota on the west. The water boundary on the west is the Mississippi and St. Croix rivers. Several times during territorial days the boundaries were changed. The territory of Wisconsin was at one time a part of Indiana Territory and later

of Michigan. The present boundaries were fixed by Congress on the admission of Wisconsin as a state.

The Plan of this Book. These advantages of our state will lead us at once to see that we live in a state that is worth knowing more about. The fields, the factories, the creameries, the dairies and the minerals of Wisconsin are known all over this great country of ours and in many foreign lands. We are going to study those things that are of most use to us as citizens of the state. We must know how the land was made and changed, the value of the soils and their products, and the influences that have led to the industries of the state and that have brought about the present condition of commerce and prosperity. We shall find out why the state has become such an important one in the markets of the country and indicate what is the promise for the future.

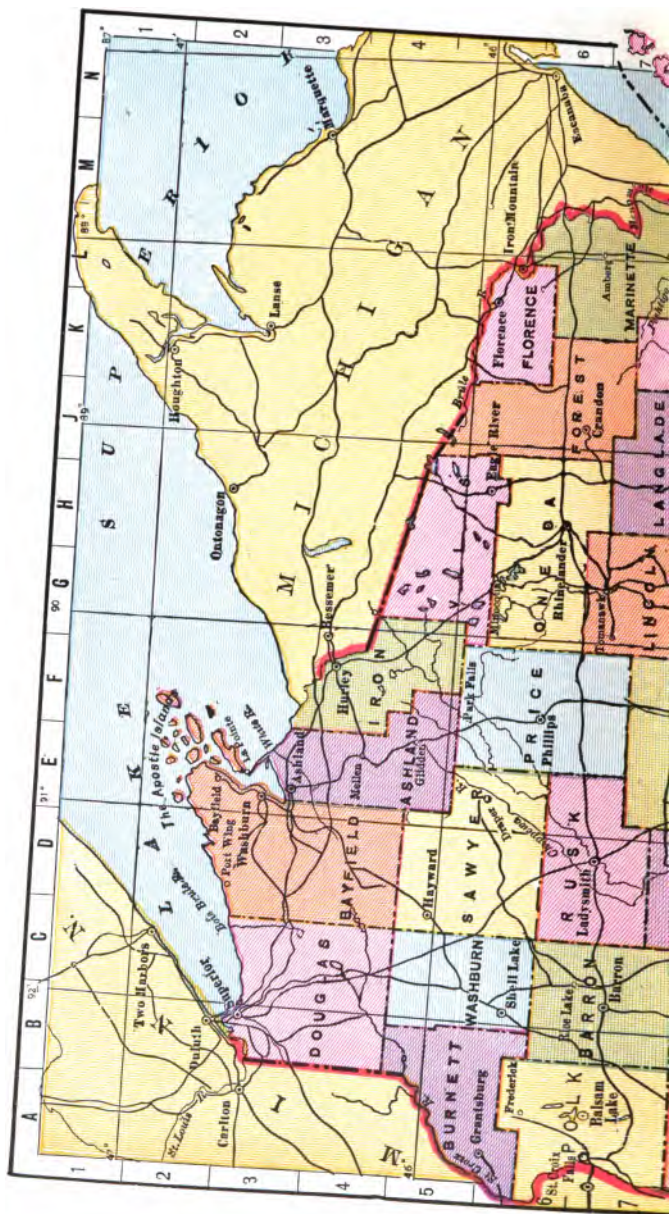
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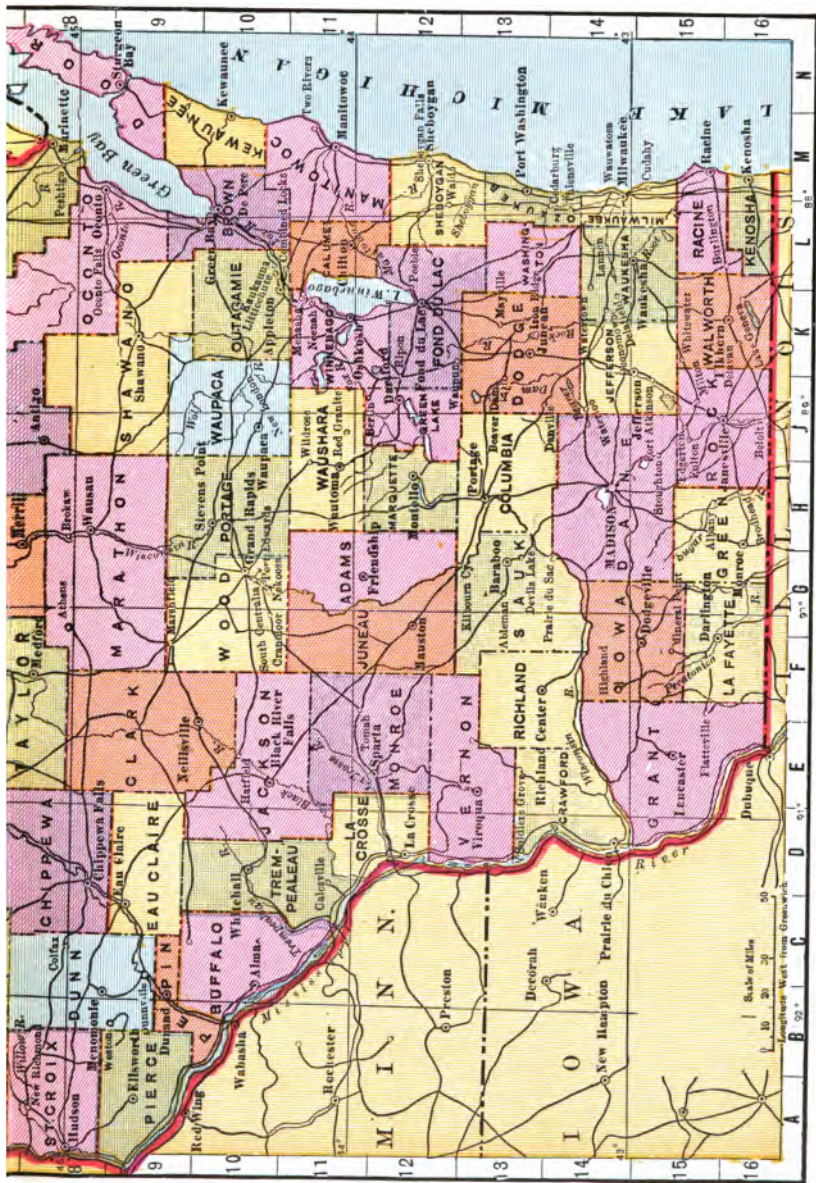
This book is intended for pupils who desire to learn more about their state than can be obtained from the ordinary text in geography. The author believes that the causes that produce a geographical fact are more important to a pupil than the fact itself, and the causal relation is, therefore, made prominent throughout the book. While the book is essentially an Industrial Geography, since it treats of the industries growing out of the natural resources of the state, yet the physical features are discussed somewhat fully because they not only form the foundation of the industries at the present time, but they have the possibilities of the industries to be developed in the future.

Wherever possible, it will be found advisable to study the home region by the field method so that the habit of investigating his surroundings will be encouraged, while the pupil is gaining information at first hand.

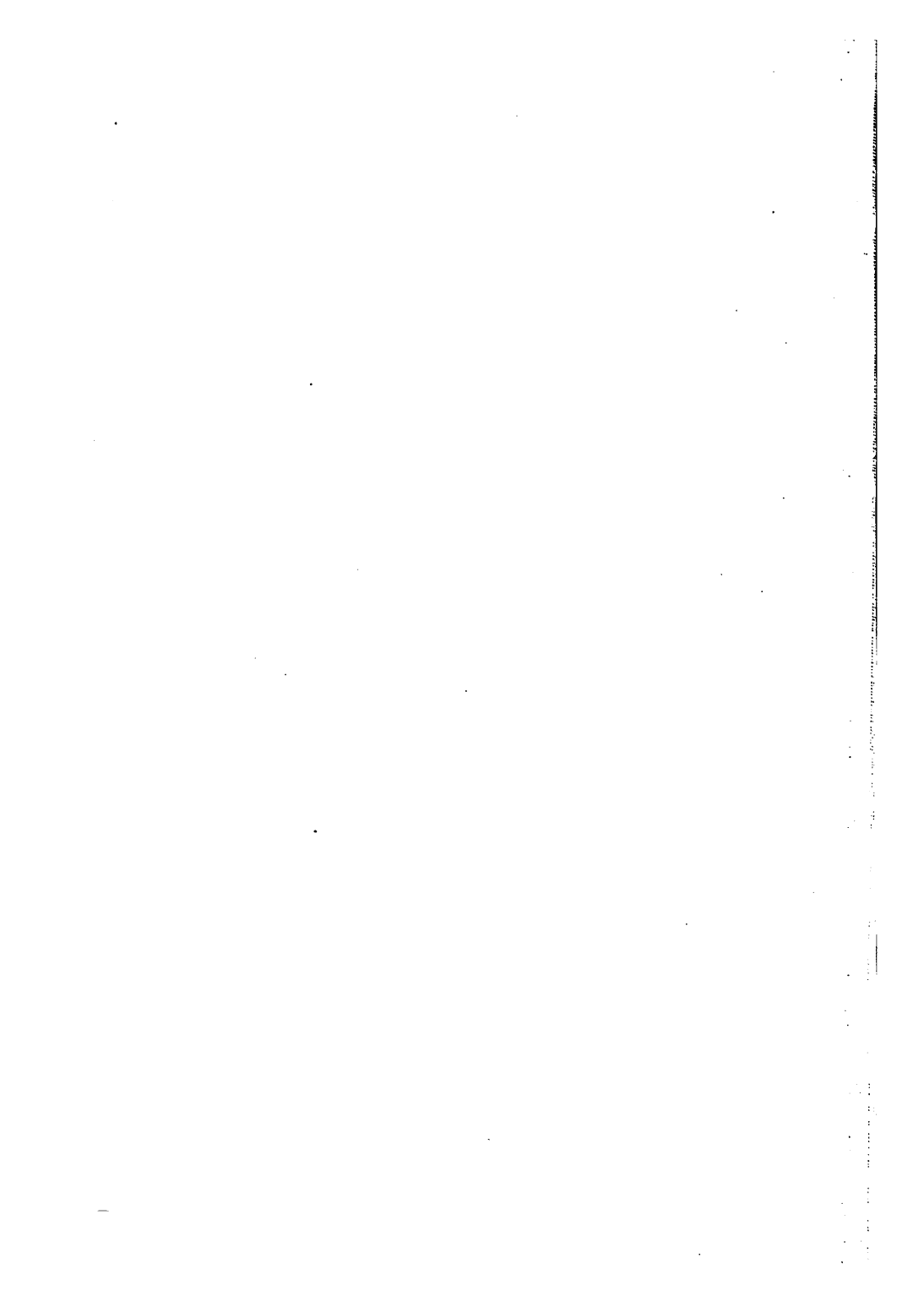
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The contour maps referred to in the text may be obtained for five cents each from the U. S. Geological Survey, Washington, D. C.

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WISCONSIN



CHAPTER I.

GEOGRAPHY IN THE SCHOOL ROOM.

Many facts of geography are learned outside of the school room. Every day we see, hear or read something new about things in our own or other countries that gives us new geographical ideas. But there are many things that can be better learned with the assistance of a teacher. Books, maps, charts, and many other things are used so that we may better understand the countries that are far away.

Home Geography. The home with its varied interests forms the foundation for all things pertaining to an education. Particularly is this true of geography. The civilized world, with all its many different peoples, products and customs, is but a combination of homes and home surroundings. Much valuable information may be obtained from a visit to a factory, and boys and girls should visit a factory in the community in which they live. These visits should be made in company with the teacher or some older person who should see that every change from the raw material to the finished product is understood. If living in the country districts, the boys and girls can study the home products at home and look at the factories when they go to the city; and if in the city, the factories may be studied first and the local products when they go to the country. Wisconsin has so many factories in small cities and villages that this kind of work can easily be done.

Field Work. Some things in the study of geography can be brought into the school room and examined, but many others cannot. Land surface, the most important of the geographic elements, must be studied in the field where the forces of nature are at work producing the changes of landscape. An untrained eye would never see these changes, even though they were described in the books, but a few field lessons at the right time will make these vital points clear and awaken a lifelong interest in the beauties of nature.

If the field lessons are taken, how much clearer and



Fig. 1.

School Garden. Eighth Grade Children Making a School Garden, Jefferson County.

more vivid the ideas on land surface will be, and if the home region is understood by having seen it under the direction of an older person, how much easier it will be to understand places far away. Wisconsin has many places that are peculiarly interesting in their structure and some of these places people have traveled hundreds of miles to see. Ask your teacher to take you to the places of

interest in your own locality and then you will understand and appreciate the wonderful structure of our own state.

Maps. Boys and girls sometimes think that maps are hard to understand and particularly are they hard to draw. This should not be if the map study is approached in the right way. You have no trouble in making a map of a place that you have seen or in understanding maps made



Fig. 2.

A Cave in the Sandstone. Students of LaCrosse Normal in Field Work.

by your friends to illustrate places with which they are familiar. If you make a map of the surface that you study while in the field, it will always be clear, and maps that others have made will be clearer too. Map drawing will impress the extent of the surface on the memory, just as the imagination reproduces at any time a surface that has been studied and mapped in the field.

Contour Maps. Ordinary maps show extent of surface only, but contour maps represent the elevations and depressions also. On contour maps lines are drawn along certain elevations above sea level, and as the surface is irregular the contour lines must be irregular. Fig. 3 is a contour map of a portion of Wisconsin. Follow out the lines and find the hills and valleys. Since you can find the exact location and slopes of the hills and valleys, can you not imagine how the land would look? The United States Geological Survey has mapped a large part of the United States in this way, including a considerable portion of Wisconsin.

Models. Models of places that have been studied in the field can be easily made, since they are but reproductions of maps and pictures that already exist in the mind. It is easy to make a model from a contour map if the lines be carefully traced out and the landscape brought out in the imagination. Models in geography should always be made as the interpretation of maps, so that they will help to impress the features shown by the contour maps, or any other maps that are used for modeling.

Reference Books, Pictures, Etc. In the pursuit of any study it is well for students who think for themselves to read other sources of information than the text book. If the pictures in the text are well chosen they are of more value than the text for rapid study, since they represent at a glance that which would take many words to describe.

Much has been written that can be used in the study of Wisconsin geography. Among the most important publications are the following:

Case, Physiography and Geology of Wisconsin.

Thwaites, Down Historic Water Ways of Wisconsin.

Thwaites, Wisconsin.

Bulletins of the Natural History Survey of Wisconsin.

There are about twenty of these, and they should be in

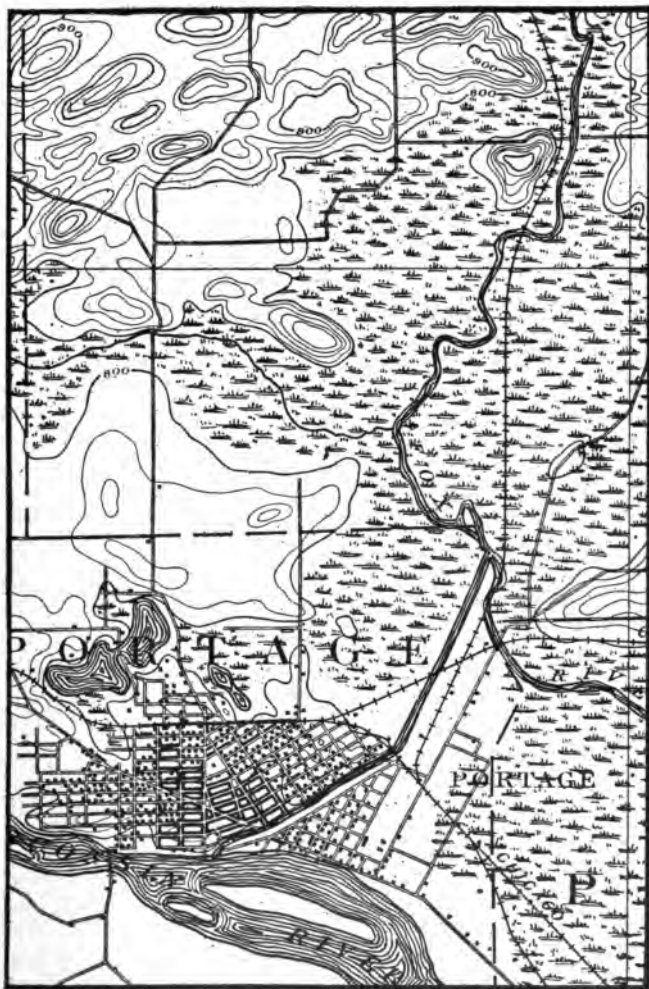


Fig. 3.

Map of Region near Portage, Wis. Irregular Surface Shown by Contour Lines. Contour Interval, 20 feet.

every township library. They are distributed as printed. Information about those that are for free distribution may be obtained by addressing the Natural History Survey, Wisconsin.

Reports of Agricultural and Horticultural Societies of Wisconsin.

Census Reports of the United States.

The Blue Book of Wisconsin.

Bulletins of the Agricultural College, Madison.

Reports of the Bureau of Statistics.

The reports of Wisconsin Agricultural and Horticultural Societies and the Bulletins of the Agricultural College may be obtained free of charge by addressing the secretaries of the societies at Madison. The Blue Book and the reports of the Bureau of Statistics may be obtained by writing the Commissioner of Labor, Madison. The Census Reports of the United States may be secured by requesting them of a congressman at Washington, D. C.

CHAPTER II.

THE BUILDING OF LAND MASSES.

In order to understand the structure of the Wisconsin land mass we will study the processes used by nature in building all land forms.

Volcanoes. While the earliest condition of the earth is not known, it is believed that very early in its growth, after a crust had formed on the outside, the melted interior frequently poured out upon the surface in the form of lava. This lava soon cooled and became hard rock like the crust which it overflowed. An opening from which melted lava is poured out is called a volcano. As the earth's crust became thicker and harder, the volcanoes still continued, though less frequently, to pour out lava from the interior, piling up into mountains or spreading out in wide layers of volcanic rock. This is the first kind of land building.

The Beach. On the shore of an ocean or large lake is a sandy beach over which the waves move back and forth as they are driven by the wind. On the beach is found waste material washed down from the land, such as large and small rocks, sand, clay, and sometimes shells of various kinds. These materials are dashed against the rock of the shore, or ground heavily against each other by the waves in time of storm. This wave action assort the material according to weight, leaving the largest and heaviest on the beach or near it in the water. The shells may be deposited in the sand or clay or carried into deeper water where they are heaped together more or less broken

and mixed with clay. At the mouths of rivers this regular arrangement is changed by the delta which is formed far out by the currents of the river.

The Continental Shelf. The material carried out some distance into the water is laid down in definite order. The distance to which the material is carried is greater in shallow than in deep water, but in all cases the order is the



Fig. 4.

Storm on Lake Superior. Waves Smoothing and Assorting Debris on the Beach.

same. First, sand near the shore, then clay and shells, and lastly, lime. Sometimes the currents of the ocean sweep over these deposits and carry them farther out, thus making the continental shelf wider, though lessening its depth. Lime deposits are sometimes formed in quiet water near the shore or far out around islands by coral animals

and by the accumulation of the hard bony parts of other sea animals.

Rocks formed in this way are called sedimentary, because they are formed from sediment in water. After many long ages these deposits become hardened into rock and, if the coast line rises, which is often the case, the continental shelf becomes land.

The Coastal Plain. The continental shelf, when elevated by the upward movement of the earth's crust, is called a coastal plain. Long continued movement for millions of years makes the coastal plain broad and sometimes lifts the inland masses into a plateau or folds them into mountain ranges.

The Work of Erosion. The weathering of rocks and the erosion by water soften the surface and carry it down to the sea. Coastal plains recently elevated are found surrounding many of the land masses of the world, but as the rocks are soft the rivers easily cut deep gorges in them. Deeper down and farther from shore the rock is more firm and erosion is less rapid, so that the older the rock becomes, the more slowly it is reduced by the action of weather and water.

The surface is sometimes reduced by the influence of dry air, as in deserts, and deposits may be made on land by winds, as in sand dunes, or at the sides of streams, or at the bases of hills or sometimes mountains. Deposits made on land in this way are found in many parts of the United States.

The Archaean Rocks. The oldest rock formations that we know are the Archaean. The rocks that were formed in this period of the world's growth are much mixed and very hard, and they include the different kinds of granite and other rocks of a similar nature. Since the Archaean rocks formed the land of the earliest time, it is evident that all the later rocks have been

made from them, so far as we know. The Archaean rocks are well represented in Wisconsin.

The Huronian Rocks. The erosion of the Archaean rocks caused the building up of a series of deposits in the ancient ocean after the manner just described. These rocks are so old that they have nearly all been carried away by erosion, but a narrow border of such rocks remains around



Fig. 5.

Giant's Grotto, Lake Superior. Shows the Cutting Power of Waves.

Lake Superior and on the north and east of Lake Huron. The finding of these rocks on the shores of Lake Huron first led scientists to call them Huronian rocks.

The Keweenawan Rocks. The Keweenawan series consists of rocks partly sedimentary and partly volcanic, the latter consisting of layers of lava that were poured out by some ancient volcanoes. These rocks contain no records of life and are found on top of the Huronian in places

where they have not been worn off. Examples are found along the border of the Old Land in the northern part of the state.

The Cambrian Rocks. Resting on the Keweenawan lava and sandstone beds and formed from the erosion of previously formed land masses, are found the Cambrian series of sandstone and limestone. The Cambrian series contain impressions of animal and plant life and are the oldest rocks to produce positive evidence of animal life. Much of central Wisconsin is composed of Cambrian rock. The well known Potsdam sandstone belongs to this series.

The Ordovician Rocks. These rocks consist mostly of limestone, sandstone and shales. Many fossils are present and indicate the great abundance of both plant and animal life. The Galena limestone, the lead-bearing formation of the southwestern part of the state, belongs to this series.

The Silurian Rocks. These are found in the limestone ridges of the eastern and southern parts of the state and are of great economic importance. The Clinton limestone, one member of the series, is the source of important iron beds in Dodge county, and the Niagara limestone, the other great member, is used for building stone and for the production of lime.

The Devonian Rocks. The rocks of this series are sandstone, shale and limestone. They are found resting on the Silurian layers in the eastern border of the state. In this series of rocks are found the remains of great quantities of plant and animal life, especially of fishes, which are so abundant that the Devonian is called the Age of Fishes.

Later Rocks. After the Devonian rocks were deposited the process continued until series after series was formed from the existing land masses. These series of rocks were, naming them in order: Carboniferous, the

coal-bearing rocks; the Cretaceous, the chalk-bearing rocks; the Tertiary, a series formed so recently that the layers are not yet solidified. The Quaternary is a name given to the glacial deposits and to the deposits now in progress of formation. The deposits later than the Devonian are not found in Wisconsin, except the Quaternary, which will be discussed in the Chapter on Glaciation.

CHAPTER III.

THE BUILDING OF WISCONSIN.

The First Land. The method of building land masses is well illustrated in the gradual building up of the State of Wisconsin. The first land in North America was formed at a very early period in the world's history and, although most of this land has been covered up by later deposits, it is believed that some of it may be exposed in the Old Land area of Wisconsin. (See Fig. 6.)

The First Continental Shelf. When the first land in our state was covered with the ocean, the deposits of gravel and clay were probably obtained from land to the north. These early sedimentary rocks were Huronian sandstone and shales, which have since been solidified into quartzite and slates. They are the sources of the iron ore in the northern and southern parts of the state.

The Great Volcanic Flow. On top of these deposits, possibly while they were under water, there came a huge outpour of lava from some volcanic centers around Lake Superior, which covered a large portion of northwestern Wisconsin. There were several of these flows and they are supposed to have extended a considerable distance down into the state, but they have been eroded until they are now found only in the northwestern part of the state, around Lake Superior. These lava flows and the rocks which accompany them are the Keweenawan rocks and they contain deposits of copper similar to those of the upper peninsula of Michigan.

The Old Land or Granite Area. In the northern part of the state, in the region marked Old Land, is found a portion of the first permanent land of Wisconsin. The exact age of its upheaval is not known with certainty, but it was after the Keweenawan lava flow, and it may have been after the formation of a part of the Cam-



Fig. 6.

Model by E. C. Case.

Relief Map of Wisconsin, Showing Main Divisions of Surface. The Old Land is the Granite Area, the Northern Part of Which is the Keweenawan Lava Flow. The Low Land is the Sandstone Area; the "Cuestas" or Ridges Include the Limestone Area.

brian sandstone. When the land was brought up it was surrounded by water and is sometimes called "Isle Wisconsin." From this land mass, by erosion and deposition through long periods of time, the remainder of our state and parts of other states to the west and south of us have been built.

The Formation of Lake Superior Basin. The region now occupied by Lake Superior Basin seemed to bend around the old Archaean area of Wisconsin, forming a synclinal trough. This trough rises out of the lake at Ashland and extends southwestward into Minnesota. During this period of sinking there were many fault lines or breaks in the strata extending southwestward through the state. One of these passed near the city of Superior, causing the land in that vicinity to drop several hundred



Fig. 7.

Wisconsin Geological Survey.

Bird's Eye View of Superior Harbor. The Harbor is Formed by Sand Bars Built Across the Head of the Lake by the Waves.

feet, forming a depression which has since become the head of Lake Superior. The sandstone which was at the surface when the basin began to fold is found at the bottom of the present Lake Superior. This lake was probably formed in the Tertiary period and much changed into its present form during glacial times.

An Early Period of Erosion. During this pre-Cambrian time there was a very long period of erosion, so long that we cannot get an idea of it by stating it in years. The portions of the state that were above water were subject to extensive erosion and hundreds of feet of rock were worn off and carried down to the surrounding ocean. In this way the land was reduced to a low, level plain, or peneplain, and the harder places that could not be eroded so rapidly were left higher than the surrounding country.



Fig. 8.

Rib Hill Near Wausau. A Knob of Hard Rock in the Granite Area. Elevation 1942 feet.

These hills of Huronian rock are called "Monadnocks" and are well illustrated in Wisconsin by Rib Hill and Baraboo Ridge.

The Limestone Periods. The limestone beds are found east and south of the great sandstone layers in the state. Passing southeastward from the sandstone we find first the hard Magnesian limestone of the Ordovician rocks (See Map, Fig. 6), then the soft limestone and shales

of the Ordovician, which have been eroded into the Green Bay depression, extending from Green Bay southwestward into Illinois and, lastly, the harder limestones of the Clinton and Niagara divisions of the Silurian rocks and the softer Devonian shales and limestones near Lake Michigan.

Some of these beds seem to have been formed in deep water, but others are beds of coral, which form near the shore. In some places the limestone is pure and hard, while in others it is much mixed with sand and clay. The layers of hard limestone form most of the rapids and waterfalls in the eastern and southern parts of the state.

The limestones of the state do not show any indications of land life, but the fossils found in them prove that the sea was literally filled with millions of animals ranging from microscopic forms to gigantic Crustaceans several feet long.

A Later Period of Erosion. The latest deposit in Wisconsin, except the glacial drift, is the Devonian, which indicates that the region included in Wisconsin has been land ever since that time. During all this great expanse of years the softening and cutting action of weathering and streams has been going on. This erosion has had a great effect on the surface of the state as is shown by the deep gullies, especially in the southwestern part. Much of the Silurian limestone has been removed, while the Devonian rocks, which probably once covered much of the southern and southwestern parts of the state, have all been removed, except a small part near Lake Michigan in the vicinity of Milwaukee.

The material eroded from Wisconsin was carried down to the sea south and west of us, while that area was being added to the central part of North America.

No Coal in Wisconsin. While coal beds were forming in the marshes in the regions south and west of us, Wisconsin was dry land and hence not a coal bed is found

within its borders. During the time that the coal was being formed in the other states, the rivers of Wisconsin were becoming deeply intrenched and the land took on a very old appearance.

The Effect of Glaciers. After this long period of erosion there came a period of glaciation which greatly changed the surface appearance of the entire state, except the southwestern part. The land which was well eroded, and in some places deeply intrenched by the action of streams, was covered by a mass of mixed gravel, sand and clay. (See Chapter IV.) The appearance of the landscape before the glaciers had done their work may be judged by that of the Driftless area, parts of which have remained the same to the present time.

CHAPTER IV.

THE WORK OF GLACIERS.

We have found in Chapter III how the rocks of Wisconsin were formed and how the land was gradually built up. In going over the state, however, one does not see these rocks very often, but instead he finds that the surface is covered with a mass of gravel, sand and clay, and often large boulders which seem to have no connection with the rocks beneath. This covering of rocks is the work of the ancient glaciers and is known as the "drift."

Glaciers of the Present. Glaciers are found in the high mountains of the western United States, and in Alaska, and in many other parts of the world. Great masses of snow collect in the valleys of the mountain tops and the weight becomes so great that the whole mass moves very slowly down the mountain side. At the lower end the mass of snow is melting and refreezing as the weather is warm or cool, so that the snow becomes a sheet of moving ice which wears away the rocks of the sides and bottom of its valley and carries the gravel, sand and clay along with it. When the long warm summers come and the glacier melts back the eroded material brought down by it is left strewn along the valley.

Ancient Glaciers. A long time ago, when the climatic conditions in North America were different from those at the present time, great masses of snow were formed on high plateaus east and on plains west of Hudson bay in Canada. These masses of snow, not melting in summer, accumulated from year to year, reaching great thicknesses,

and extended far southward, finally taking on the movements common to glaciers. They moved outward from the centers of snow accumulation as great sheets of ice, which, under their own pressure, became plastic and moved outward in lobes like tar. These lobes of ice moved over the hills and river valleys of the land and scraped off most



Fig. 9.

Glacier Descending a Mountain Valley in Switzerland. A Stream Issues from the Front.

of the soil and clay and the loosened masses of rock. This waste was carried forward until it was dropped into a depression, or piled around an unyielding rock, or left scattered over the land by the melting of the glacier.

The southward movement of the ice sheet from west of Hudson bay was probably the first to reach the United

States, but it scarcely touched Wisconsin. Later came an advance of ice from the east and south of Hudson bay which moved as far south as the northern part of Wisconsin and along the eastern border of the state, thence southwestward through Illinois to the Ohio river. This ice sheet melted away into Canada. Another cold period coming on, the glacier again advanced from a point south of Hudson bay



Fig. 10.

Model by E. C. Case.

Glacial Relief Map of Wisconsin. Shows Drift over the State, Culminating in the Terminal Moraine.

into northern and eastern Wisconsin and down to central Illinois.

The Glaciers of Wisconsin. As stated in the preceding paragraph, the first glacial invasion of Wisconsin was by an ice sheet from the plain west of Hudson bay, which touched only the western border. After this the glaciers



Fig. 11.

Map of a Portion of the Terminal Moraine, Showing the Irregularities and Elevations of the Surface by Contour Lines. Contour Interval, 20 feet.

came down twice over the northern and eastern parts of the state. The map (Fig. 10) shows the margins of the different ice sheets and also shows the glacial areas of the state. Much earthy debris was carried in the front part of the glacier and when the melting season came this material was left in irregular hills and depressions. This marginal deposit forms a ridge across the northern part of the state and along the eastern side, called a terminal moraine. As the ice melted back and advanced again several times, it formed later moraines almost as large as the first one.



Fig. 12.

U. S. Geological Survey.

Scene in Driftless Area, Showing Ancient Landscape of the State.
Hard Rock Left by Erosion.

The Driftless Area. In the southwestern part of Wisconsin, extending just beyond the Mississippi river, a few miles into Minnesota and Iowa, is a region untouched by the ancient glaciers called "The Driftless Area." This area shows the general appearance probably presented by the entire state before the glaciers moved over its northern and eastern parts. The streams here have been working

so long that they have much larger valleys than streams of the same volume in the drift-covered parts of the state.

Effects of the Glaciers in Wisconsin. The movement of the great mass of ice over the old, well-worn rivers of Wisconsin completely destroyed the old drainage by cutting down the softer parts of the hills and filling up the valleys in some places and gouging through in others. When the glaciers melted backward the streams which followed were sometimes thrown into new channels, as the Wisconsin river in the region of the Dells, or into blocked-up old channels, as the Waupaca Chain o' Lakes. The forcing of



Fig. 13.

Field in Northern Wisconsin, Showing Effects of Glaciation.

the rivers to take new channels over rocks of varying hardness has caused many of the valuable water powers of the state.

Many small lakes were formed in the drift-covered or glaciated area, some in the valleys of old rivers, some by the irregular piling up of a mass of glacial material so as to inclose a basin, and some by the melting of blocks of ice that had been covered or surrounded by the deposits of streams running out from the melting glaciers. Many of these small lakes have been filled up by the wash into them

or by plant growth, making fertile fields, peat bogs or marshes. Many elongated hills, called drumlins, and irregular-shaped gravel hills, called kames, were formed under the ice and were left after the melting of the glacier. Overwash plains of gravel were formed also in front of the melting glacier by the streams that came out from underneath the ice.



Fig. 14.

Stream in Northern Wisconsin, Showing Effects of Glaciation.

Soils in Glaciated Regions. The soil removed by the glacier, and carried beneath it, is thoroughly mixed with the powdered rock and gravel and deposited in many forms over the land. The soil map (Fig. 39), showing the distribution of soils over the state, reveals the fact that the soils in the glaciated districts are more varied than the rocks of the surface under them. These soils are often very

productive and from dense forests they have been converted into fine farms.

The Great Lakes. As all of the glacial lobes entered the state from the basins of Lake Michigan, Green bay and Lake Superior (See Fig. 10), a study of the changes in these great basins reveals a considerable part of the glacial history of the state. These lakes may not have existed before the glaciers came, and their present form is due entirely to glacial action. When the glaciers occupied



Fig. 15.

U. S. Geological Survey.

Scene in Glaciated Region.

the lake basins and extended out on the land in lobes there were no Great Lakes. Then, as the ice melted back, a small lake was formed in front of each lobe of ice. As the melting back continued the lakes enlarged and sometimes changed their shapes and the places of their outlets. All of this history is told by the beaches and sandbars and by valleys where abandoned outlets used to flow.

The formation of the Great Lakes may be classed by stages. The first stage occurred when the lobes each had separate lakes in front of them. The one in front of the

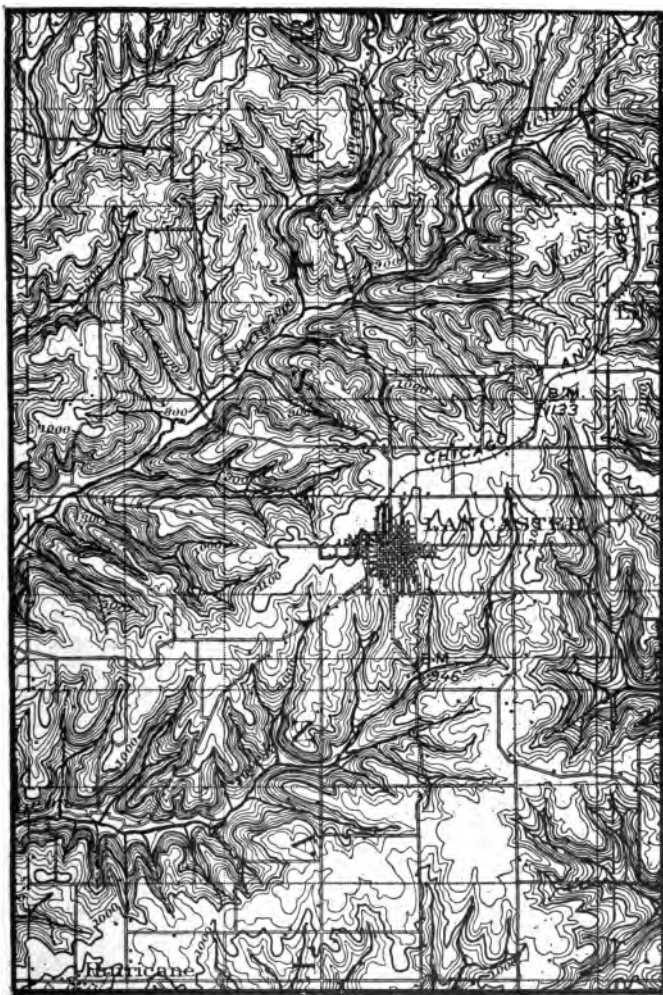


Fig. 16.

Contour Map of Region in the Driftless Area. Shows Irregularities of Surface That Must Have Been Common in Wisconsin, Especially in the Southern Part, Before the Glacial Period. Contour Interval, 20 feet.

Lake Michigan lobe is called Lake Chicago, with an outlet into the Illinois river, while the one in front of the Lake Superior lobe is called Lake Duluth and overflowed into the St. Croix. (See Fig. 17.) There was also a lake in the Green bay basin that discharged to the Wisconsin river. The second stage was called Lake Algonquin. At this time the ice sheet had melted far up into Canada, and the three Great Lakes, Michigan, Huron and Superior, having united, were discharging for a time through the Illinois river (see Fig. 18), and for a time through outlets farther



Fig. 17.

Wisconsin Geological Survey.

Lakes Duluth and Chicago.

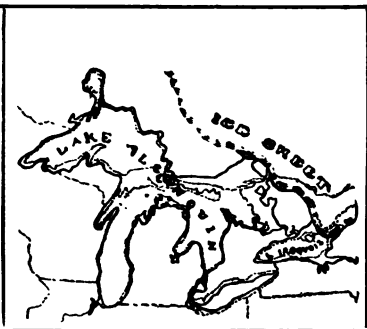


Fig. 18.

Taylor & Leverett.

Lakes Algonquin and Iroquois.

east. The third stage, called Nipissing Great Lakes, was after the ice sheet had disappeared from the region and the lakes were much the same as they are today, but having an outlet through Georgian bay and the Ottawa river. (See Fig. 19.) All the changes thus far had been brought about in part by the melting away of the ice sheet and opening outlets through the rising of the land in the north-east which followed the unloading of the ice weight. The change from the Nipissing stage to the present Great



Fig. 19.

Modified from Taylor.

Wisconsin Geological Survey.

Nipissing Great Lakes. Figs. 17, 18 and 19 Show the Development of the Great Lakes as the Glaciers Retreated. While the Glaciers Covered the Lake Basins, Lake Duluth, as well as Lake Chicago, Overflowed into the Mississippi River. (Fig. 17.) In Lake Algonquin (Fig. 18), the Ice Sheet had Freed the Lake Area, the Overflow at Duluth was Abandoned and the Lakes Emptied Into the Atlantic Through the Mohawk-Hudson. In Lake Nipissing (Fig. 19), the Glaciers had Disappeared and Lakes Superior and Huron Emptied into the St. Lawrence Through the Ottawa River.

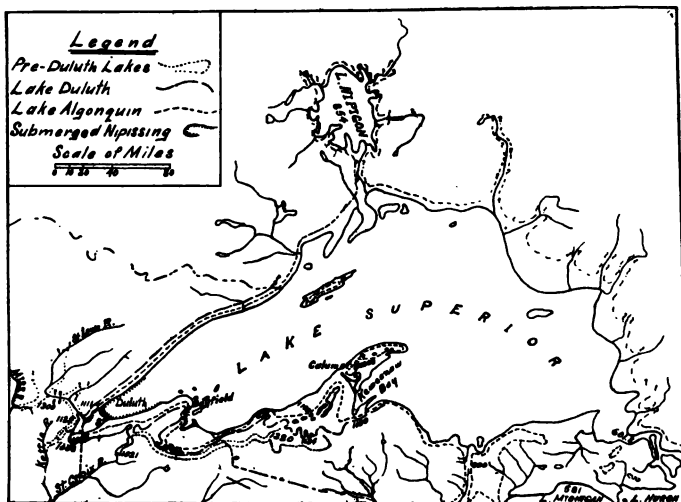


Fig. 20.

Frank Leverett.

Map Showing the Successive Outlets of Lake Superior During the Changes Noted in Figs. 17, 18 and 19.



Fig. 21.

Contour Map Showing Irregularities in Glacial Drift. Contour Interval, 20 feet.

Lakes with outlet through Lake Erie and over Niagara has also resulted from the northeastward uplift, causing the Georgian bay outlet to be abandoned.

The history of Lake Michigan through these changes has been chiefly the shrinking from higher outer beaches to lower ones, but the history of Lake Superior is more complex.

Mr. Frank Leverett, of the United States Geological Survey, has worked out the history of the Lake Superior basin and the old shore lines are shown in the map here given. Fig. 20.

CHAPTER V.

WISCONSIN WEATHER.

People generally measure the weather by their feelings. We say it is hot or cold, fine or disagreeable, according as it seems to us at the time. But people who study the weather have instruments such as thermometers, barometers, wind vanes and rain gauges, by which all of the elements of weather are accurately determined.

What Is Weather? When we speak of weather we refer to the condition of the atmosphere with reference to temperature, pressure, wind, moisture and rainfall. The *temperature* is measured by a thermometer. To be accurate a thermometer must be placed where the direct rays of the sun do not reach it and must be placed away from the house so that the heat of the wall will not affect it. A *Thermograph* is a record made by a self-recording thermometer used by the United States Weather Bureau. It tells the temperature for every hour in the day or night, and from it the daily, monthly or annual variation of temperature may be easily found. An isotherm is a line connecting places that have the same temperature at any given time.

Pressure of the air is measured by the barometer, an instrument so constructed that the air from the instrument to the top of the atmosphere is made to press on a column of mercury in a glass tube. This mercury rising or falling in the tube indicates the pressure of the air just as a scale weighs an article in a store. The pressure of air indicates its density because when the particles are closer together

the air is heavier and more dense, and when they are farther apart it is lighter or less dense. A line connecting places of equal pressure is called an *isobar*.

Wind is caused by difference in pressure. Heavier air moves toward lighter air and makes it rise, just as a balloon is made to rise by the heavier air moving under it and pushing it up. If the difference in pressure between two places is great the wind is swift or strong, while if the difference is slight the wind is a gentle breeze and sometimes is almost calm.

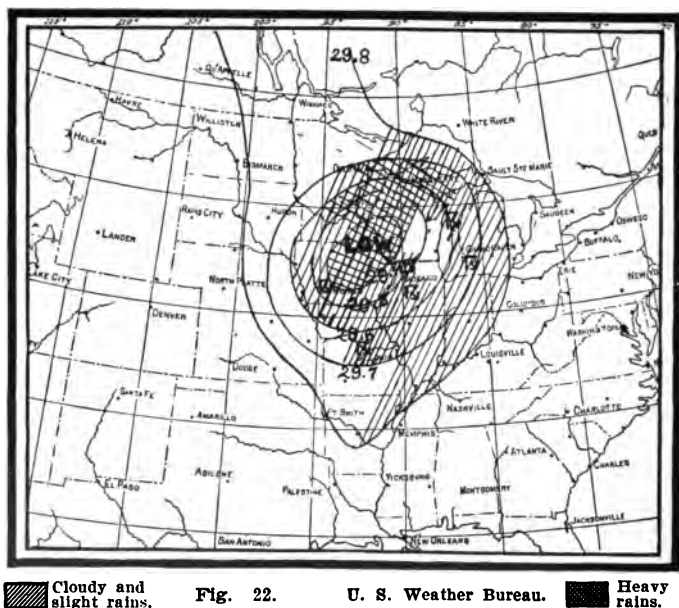
The *moisture* of the air is an important factor in weather. Water becomes invisible vapor and is scattered through the air by the process of evaporation, which is rapid when the air is warm and slow when it is cold. The vapor is affected very little by temperature, but the air expands readily with the addition of heat and contracts when heat is taken away. Therefore, while the exact amount of moisture in the air may remain the same, a cooling of the air will increase the relative amount of moisture and cause the atmosphere to be more nearly full. When the air is full of vapor it is said to be saturated.

Rainfall results from the condensing of vapor. When the air is cooled and contracts beyond the point of saturation the vapor condenses into clouds and then if these conditions continue it falls as rain. Snow falls if the temperature of saturation is below the freezing point, or 32° Fahrenheit. Dew and frost are formed in a similar way except that they form during clear nights on plants and other cold objects instead of forming into clouds and falling.

Kinds of Weather. Weather is classed as cool or warm, cold or hot, according to the temperature. It is also called dry, cloudy, or rainy, according to the amount of moisture. The kind of weather is of great importance in the raising of crops and the growth of stock. Warm and

moist weather promotes the growth of all kinds of vegetation, while dry or cool weather retards growth. Heavy dews are also a great aid in the growing of crops. Wisconsin has sufficient rainfall, usually, and there are no places in the state where irrigation is necessary.

Types of Weather. The weather seems to change



Cyclone, Low Barometer Storm, May 15, 1909. This Type of Weather is Most Frequent in Wisconsin in Summer.

from week to week and from year to year, but when we study it closely we find that the changes are always according to law. There are two general types of weather in Wisconsin, the cyclonic and the anti-cyclonic.

The *cyclone* is the principal cause of the winds of Wisconsin. By this is not meant the small twisting tornado

with the funnel-shaped cloud so destructive to life and property. A cyclone is a circle of winds of large area many hundreds of miles in diameter, which is formed by the air moving from a place of greater density to a place of lesser density, called a "low," at which place it rises. The rotation of the earth causes the air to move around the "low" and makes the air on the east side of the center come from the south and on the west side from the north. (See Fig. 22.) Rain is produced on the east and north sides of a cyclone because the air is moving from a warmer to a colder area and also around the center, because the air is rising. The temperature is warmer on the east and south sides and colder on the west and north sides.

These storms move from west to east across the United States and one moves across Wisconsin about once each week on the average throughout the year. They bring warm, moist weather and often rain on the east side, and colder weather on the west side. In this way most of the rain in our state comes from the Gulf of Mexico. All have noticed, doubtless, that cooler weather and north wind always follows warm weather and you have probably noticed also that rain falls during the warm weather or at the change from warm to cold. These storms enter Wisconsin from the west or northwest and the path of the "low" is called the storm track.

The *anticyclone* is the opposite of the cyclone and is a storm where the pressure of the air is high. (See Fig. 23.) The air falls from the upper atmosphere and moves out in all directions, sometimes whirling a little in the opposite direction to that of the cyclone. The anticyclones move slowly to the east or southeast across the country, and the weather in Wisconsin is frequently controlled by them. They are more frequent in our state in the winter time and the long, bitter cold spells of our winter are generally due to them. As a general thing the weather in our anti-

cyclone is cold, clear and bright and the wind not strong. They sometimes bring rain or snow on the outer edges.

Many of the storm tracks of the United States every month pass through Wisconsin and give us changeable weather most of the time.

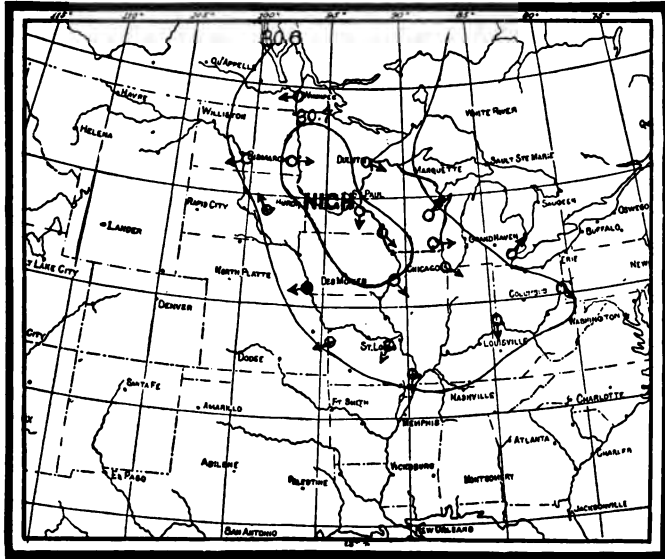


Fig. 23. U. S. Weather Bureau.
Anticyclone, or High Barometer Storm, January 10, 1905. This Type of Weather is most Frequent in Wisconsin in Winter.

Smaller Storms. We are all familiar with thunder storms. They come in the summer and autumn and bring heavy rain and often strong winds. Our hardest rains come in thunder storms, and in our state they generally come from the west or southwest. They are often accompanied by hail and sometimes do great damage to crops. Destructive tornadoes are rare, but have occurred in several parts of the state.

CHAPTER VI.

CLIMATE OF WISCONSIN.

Every year has its own peculiar weather, due to the various causes of which we have just learned. But we do not judge the climate of a place by the weather for one year, because it varies from year to year. The climate of a place is the average of its weather for a long period of time. Like weather, climate depends upon certain general factors, such as position with reference to latitude and altitude, masses of land and water and general direction of winds.

Effect of Position. The latitude of Wisconsin, 42° to 47° , places it in the North Temperate zone, where long, cold winters and short, warm summers prevail. Its length north and south is over three hundred and fifty miles, a distance so great that there are great differences in temperature between the northern and southern parts. The longest day, about June 22, is over sixteen hours in the northern part and about fifteen hours in the southern, while the longest night, about December 21, is the same as the longest day in the summer.

The altitude of Wisconsin varies from six hundred feet in the south and southwest to over fifteen hundred feet in the northwest. This is not sufficient, aside from other factors, to greatly increase the severity of the climate.

Effect of Land Masses. Large land masses get warmer than large bodies of water in summer and colder in winter, because the land takes heat and gives it up more readily than water. As Wisconsin is situated in the heart

of the continent of North America and surrounded by level land for many miles on every side, its winters are longer and colder than they would otherwise be and its summers shorter and warmer. This effect is modified by the winds which bring the climate of the lands of the southwest, west and northwest into the state.

Effect of Winds. It has already been stated that the cyclonic winds are the principal ones in Wisconsin. As the east side of a cyclone is the warm side, the air from the south and southwest as far as the Gulf of Mexico is drawn up over the state, while on the west side of the cyclonic area the air from the northwest and north comes in. As the cyclone moves eastward, this gives us a great variety of winds, but they are chiefly from points west of our meridian. The prevailing wind in the southern part of the state, at Milwaukee, is from the southwest, and in the northern part, at Superior, is from the northwest.

Effect of the Great Lakes. To the north of Wisconsin lies Lake Superior and on the east Lake Michigan. These are large bodies of water and modify our climate somewhat. Their influence is not felt very far back from the lakes, because the prevailing winds are from the west and also because there is a ridge a few miles west of Lake Michigan, which keeps the influence of the lake from the interior and a similar highland in the northern part, which destroys the influence of Lake Superior. (See Physical map, Fig. 27.) The great number of smaller lakes through the state also modify to some extent the severity of the climate.

Temperature. The temperature of the state varies greatly in different parts and is subject to great extremes. The average temperature is highest in the southeastern part of the state and lowest in the northwestern part, but the highest and lowest temperature ever recorded by the United States Weather Bureau were in the southwestern

and western parts. The topography of the country and the direction of the winds, as well as the lakes, are probably responsible for this condition.

Rainfall. The State of Wisconsin has only a medium amount of rainfall, but it is sufficient for all agricultural purposes. The yearly average, including snow fall, is over thirty-two inches, a little less than that of Illinois, but more than that of Minnesota. Most of the rain in the state is

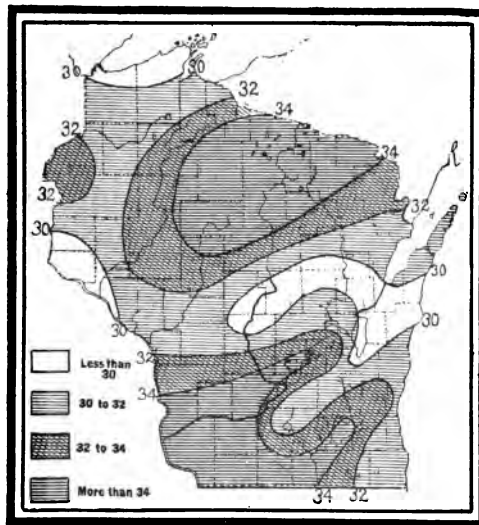


Fig. 24.

W. C. Deveraux in King's Geography.

Mean Annual Rainfall in Wisconsin.

brought by southwesterly or southerly winds and comes originally from the Gulf of Mexico, but some rain and considerable snow, in the eastern and northern parts, are brought by the easterly and northeasterly winds from the Great Lakes. Of the thirty-two inches of rainfall in the year, nineteen and one-half fall in the spring and summer, at the time it is needed in the growth of crops, while less

than five inches fall during the winter months. During the autumn, while harvest is being gathered, the rainfall decreases to an average of eight inches, which gives ample opportunity for harvest.

Summary of Weather and Climate. The weather of Wisconsin is largely the result of the cyclones and anticyclones that sweep across the state in their eastward course. The

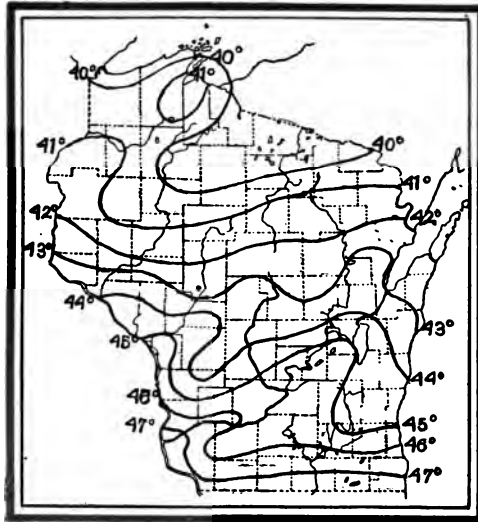


Fig. 25. W. C. Deveraux in King's Geography.

Mean Annual Temperature of Wisconsin.

cyclonic type of weather is the most common in spring, summer and autumn, while the anticyclonic type prevails in winter, although both types occur at all seasons of the year. Cold waves follow warm waves with unfailing regularity and give to our climate the stimulating influence for which it is noted. In the northern part of the state there are many dry, cold, bright days in the winter months and

a corresponding amount of cloudy weather in the spring. The western and southern parts of the state have higher temperatures and greater rainfall than other places, a fact which causes greater fertility in those regions. The cool summers in the regions of the lakes and the pine forests of the northern and eastern parts have made Wisconsin famous for its summer homes and places of rest and recreation.

CHAPTER VII

DRAINAGE OF WISCONSIN.

The running off or "run off" of the surface water of a region is called its drainage. In our state the drainage is controlled by three slopes, the principal one leading south-

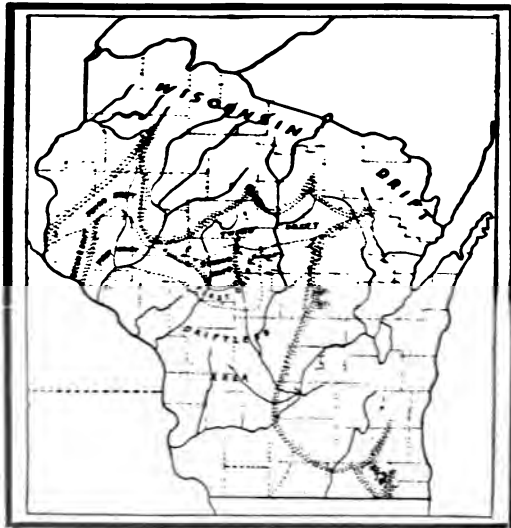


Fig. 26.

Wisconsin Geological Survey.

Map Showing Glacial Drift and how the Rivers Pick Their Way Through the Drift.

westward to the Mississippi, another to Lake Michigan, and the smallest one to Lake Superior. Each of these slopes is occupied by streams, but some of the slopes in the

northern part are poorly drained on account of the glacial drift.

The Lake Superior Coastal Plain. The streams emptying into Lake Superior are small and short. They rise in the Archæan, or Old Land, south of the lake and flow generally in narrow and deep gorges, which often con-



Fig. 27.

Drawn by Olga Ekern.

Drainage and Relief Map of Wisconsin, Showing the Principal Rivers and Their Relation to the Surface Features.

tain falls and rapids. The land of the coastal plain is red clay, except in the Bayfield peninsula, and in some places near the southern border of the plain, where it is mostly sand. The principal rivers are the Bois Brule and the White on the eastern part, and the Nemadji and St. Louis on the western.

The St. Croix System. Rising in the hills of the lava flow in the northern part of the state, the St. Croix river flows southward, uniting with the Mississippi. At the watershed beyond Lake St. Croix is a well worn valley uniting the Brule and the St. Croix, through which Lake Superior formerly overflowed into the St. Croix river. Many glacial lakes are drained by the tributaries of this river and many of the streams pass over rapids and falls in reaching the main stream. The entire basin, especially at the headwaters, was formerly covered with dense forests of pine, much of which has been cut off and the land developed into a fine productive area for cereals and grasses.

The Interstate Park. At St. Croix Falls where the river leaves the lava beds there is a series of rapids, falls and picturesque canons, called the "Dells of the St. Croix." The states of Wisconsin and Minnesota have set aside several square miles as an "Interstate Park," to be cared for by the two states for the purpose of preserving this beauty spot in its natural condition.

The Chippewa System. The Chippewa river rises in the northern boundary line of the state in the Old Land, or Archæan region, and flows through the terminal moraine and through a small portion of the driftless area into the Mississippi. Its basin, once given exclusively to the lumber industry, is now a rich, productive area, with the timber, though still extensive, confined largely to the upper parts of the larger tributaries. The whole system abounds in gorgeous and beautiful scenery and the river has been styled the "Lordly Chippewa."

The Black River System. The Black river rises in the Archæan granite area and flows southwestward across the driftless area into the Mississippi. Its basin is largely a productive area for grain and dairy farming. The Black river is comparatively a small stream except in times of flood, when it becomes swollen and carries much sediment.



Fig. 28.

Interstate Park, St. Croix Falls.

Courtesy of Park Board

In the past these floods were larger and carried so much sediment that terraces or shelves of sediment were formed.

Smaller Rivers of the Mississippi System. In the Driftless area there are several rivers of considerable importance, though small. The principal ones are the Trempealeau and the La Crosse. The scenery of this region is picturesque and the valleys are as fertile as any in the state.

The Wisconsin System. The largest as well as the most important river in the state is the Wisconsin. It rises in Lake Vieux Desert, on the northeastern boundary line, flows south and west and empties into the Mississippi. It is over four hundred miles long and drains an area of 12,280 square miles. The upper waters of the basin, as far as Nekoosa, are in the Archæan area and flow through a region densely wooded, from which the forests are slowly disappearing before the energetic lumbermen. Its irregular course and the numerous lakes and swamps through which it passes are due to the glacial debris, which has changed its course in several places, producing many rapids and falls.

The Lower Wisconsin. The lower course moves more slowly over old, hard rocks, and in its last one hundred miles its bed is often obstructed with sandbars.

The Dells of the Wisconsin. A few miles above Kilbourn City the river becomes very narrow and has cut a gorge in sandstone, forming an extremely picturesque channel with grotesque spurs and inlets, producing the most beautiful scenic effects in the central part of the continent. The surrounding region is also attractive and entertains thousands of tourists annually. Below Kilbourn City the river turns to the left, makes a sharp curve around Baraboo Ridge and Portage and moves sluggishly westward over sandbars to the Mississippi. At Portage there is a low marsh between the Wisconsin and the

Fox rivers, one and one-half miles wide, through which the Wisconsin river used to flow in time of flood, before the levees were built to prevent it. This part of the river is supposed to have been much wider at the close of the glacial period, as large terraces are built on each side of the stream. At that time the Fox river emptied into the Wisconsin and water from Green bay and Lake Winnebago flowed through into the Mississippi.



Fig. 29.

North Western Railway Co.

Devil's Lake.

The Mississippi River. The western boundary of the state of Wisconsin, from the mouth of the St. Croix river southward, is formed by the Mississippi river. Its bed is wide, with numerous meanders and oxbow lakes in a large and changeable flood plain. Many islands of transcendent beauty have been formed as the oxbows are

cut off by the wandering channel of the river. Terraces are found along its banks, which are indications of ancient flood plains.

The Rock River System. A large area of the southern part of the state is drained by the Rock river. The basin is very wide in the north, like the Mississippi, and, after receiving tributaries from the drift-covered lands on the east and from the Driftless area on the west, the river



Fig. 30.

Courtesy of Park Board

Mississippi River, Showing the Wide Expanse and High Banks.

flows southward, finally reaching the Mississippi in Illinois. The country through which it moves is comparatively level, much of it swampy, and though once densely covered with hardwood forests, is now a rich agricultural and dairy section.

The Fox River System of Northeast Wisconsin. The Fox river system is the most important in the eastern part of the state. It consists of the Upper Fox and the Wolf

rivers above Lake Winnebago, and the Lower Fox below Lake Winnebago to Green bay. The watershed between the Fox and the Rock rivers consists of glacial drift and lies in a depression between two ridges of limestone, which extend from east and west of Green bay into Illinois. The region abounds in swamps, drumlins, kames and irregular drift deposits of all kinds. The preglacial topography and



Fig. 31.

Wisconsin Geological Survey.

Fox River at Appleton.

drainage has been greatly modified and the streams are wandering around in the lowest places in the drift, slowly working out valleys for themselves.

The Wolf river rises in the northeastern part of the state and flows southward, joining with the Fox about ten miles above Lake Winnebago. The upper part of the river flows over the crystalline rocks, and is very swift, but below

Shawano, where it enters the area of the sandstone and limestone, the descent is less rapid and the surrounding country more level. The whole of the Wolf river basin is in the thick moraine of the Wisconsin glacier. This basin was covered with great forests of hemlock, pine and hardwoods, and lumbering is still the principal industry. In the lower portion the cut-over lands have been made into fine farms and stock raising and dairying have been added to the products of the farm.

Beginning with Lake Winnebago, the lower part of the Fox river flows down an incline to Green bay, the descent being 166.7 feet in thirty-five miles. The bed of the river and the eastern bank are Galena limestone, which rises high on the east and extends as a prominent cliff southward into the state of Illinois. On the west side are soft shales which have weathered away into a gentle slope. The soil in this basin is extremely productive, especially for cereals and vegetables.

Other Systems of the Green Bay Basin. On the western side of Green bay there are three systems of streams that drain considerable areas of valuable surface. These are the Oconto, the Peshtigo and the Menomonie, all of which rise in the Old Land area of the northeastern part of the state and pass over steep slopes containing many rapids and waterfalls to the limestone region, across which they have a more gradual descent to Green bay. These rivers all rise in glacial lakes. This tends to give them a steady flow and makes them of great value to the logging interests of that part of the state.

River Systems of Lake Michigan. From the limestone ridge which passes from Green bay southward along the eastern shore of the Lower Fox river and Lake Winnebago to Lake Michigan the descent is about three hundred feet. The surface is thickly covered with glacial debris of the kettle moraine and the rivers wander among these

ridges and hills until they find an outlet into the lake. As the old drainage has been nearly all destroyed, the forming of new valleys over glacial ridges and rocks has made many rapids and falls, which are used for water power. The principal streams found here are the Manitowoc, Sheboygan, Milwaukee, and the Root. All of these streams have, at their mouths, good harbors and flourishing cities, which are noted for the manufacture and distribution of Wisconsin products.

CHAPTER VIII.

WATER POWERS OF WISCONSIN.

NOTE.—The letter and figure in parentheses after the rivers, lakes and towns mentioned are to enable the student to locate them readily on the map at page 12. For example, Friendship (F 10) will be found near the point where a line drawn vertically from the letter F in the margin above or below the map would cross a line drawn horizontally from 10 at the side of the map.

The water power of Wisconsin constitutes a great source of wealth. Over 130,000 horse power is now being used, and this is only a small fraction of what is possible in the future.

Uses of Streams for Water Power. Water flowing over a steep slope or over a waterfall may be used for running machinery. The power may be applied either directly to the running of the machinery of a mill or it may be used in making electricity, transporting it any distance and applying it to the running of electrical motors, which will propel any other machinery.

Early Uses of Water Power. The first uses of the streams for water power were by the lumbermen to transport the logs from the logging camps to the saw mill and to run the machinery of the mill. Sometimes dams were used to produce the required fall of water or to establish a reservoir, but frequently water power was taken from the waterfalls directly.

The Old Grist Mill. In farming communities the water power was used to run the grist mill. The mill was generally more or less of a neighborhood affair and its

profits were made by the taking of toll from the grain brought for grinding.

Manufacturing. The uses of water power above referred to require only a small amount of power, but when the population increases and the demand for manufactured products becomes greater the water power will be used extensively for manufacturing all kinds of machinery, flour, paper, textiles, etc.

Developing the Power. In order that the power may be utilized to the best advantage it is necessary that the

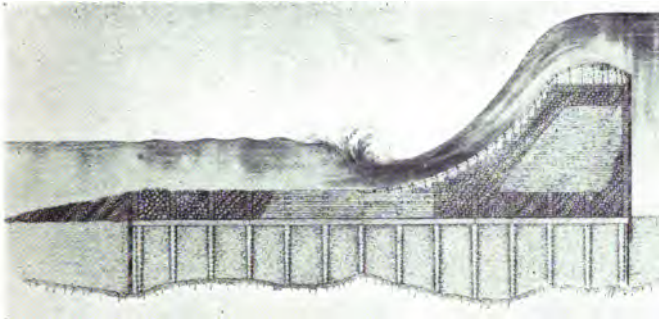


Fig. 32.

Wisconsin Geological Survey.

Dam in Process of Construction at Kilbourn City. This Water Power, Now in Use, Generates Electricity for the City of Milwaukee.

water flow be constant and as independent as possible of floods and droughts. To accomplish this a dam is usually constructed near the beginning of the rapids, which causes the water to accumulate in a lake or reservoir above the dam. From this reservoir the water is led by canals or pipes and applied to the turbine waterwheel at the foot of the fall.

Lakes as Reservoirs. Lakes, as Superior and Winnebago (K 11), are natural reservoirs and the flow of water is

practically the same at all times. The smaller lakes in the upper waters of the rivers of the state are of great value in holding back the surplus water in the rainy season. The forests, by preventing evaporation and decreasing the flow of surface water, have the same effect as lakes, and for this reason the destruction of forests in the region of the sources of the rivers has an injurious effect on the water powers below.



Fig. 33. Data from Wisconsin Geological Survey

Water Power Sites in Wisconsin, Developed or Now in Process of Development.

The Future of Water Power. The development of water power in the state is now in its infancy. Almost every river in Wisconsin has great possibilities. This is especially true of those that originate in the glacial drift, but even in the Driftless Area the difference in hardness between the Old Land and the surrounding rocks causes frequent waterfalls. It is easy to see that, with the amount

of water power in the state, the ease with which it may be developed, and the transportation facilities offered by the Great Lakes and the network of railroads, manufacturing will be a leading industry of the state.

Water Powers of the Fox River System. The waters of the Lower Fox (L 10) were the first in the state to be used extensively in manufacturing. Considerable encour-



Fig. 34. Data from Wisconsin Geological Survey.

Water Power Sites In Wisconsin. Undeveloped.

agement and assistance were given by the general government in the early stages of this development, but the water power rights are now held largely by individuals and corporations. A few small water powers have been developed on the Upper Fox and the Wolf rivers, but the greatest water power in Wisconsin within small compass is in the Lower Fox river, between Lake Winnebago and Green bay (L 10), a distance of thirty-five miles.

Manufacturing. The following is a list of the principal water powers on the Lower Fox and the uses to which they are put :



Fig. 35.

Wisconsin Geological Survey.

Combined Locks and Dam, Little Chute, Lower Fox River. Lock Used for Passing Boats Over the Rapids, and Dam for Water Power.

<i>City.</i>	<i>No. horse power.</i>	<i>Uses.</i>
Neenah (K 11)	5,400	Paper and pulp mills, flour, boots and shoes, electric light, machinery.
Menasha (K 11)	3,422	Paper, wooden ware, flour, excelsior, woolen mills, knitting factory.
Appleton (K 10)	11,414	Paper, furnishing electric light and power, woolen mills, hubs and spokes, machinery.
Cedar Dam (L 10)	4,217	Paper.
Little Chute (L 10)	3,100	Paper and flour.
Combined Locks (L 10)	4,338	Paper.
Kaukauna (L 10)	5,669	Paper, pulp, fibre, electric light machinery.
DePere (L 10)	1,840	Paper, flour, electric light.

Water Powers of the Wisconsin River System. Unlike the Fox, the Wisconsin river (E 14) has its water power scattered over a great distance, nearly three hundred miles. In its upper waters the river has a steep slope and in a few places waterfalls.

Reservoirs. The innumerable lakes in the northern part of the Wisconsin river basin act as natural reservoirs for water and the nature of the country is such that artificial reservoirs to complete the water power capacity of the river may be made at small expense.

Development. Although the logging companies have used the water power of the Wisconsin river for years, the use of the power for manufacturing is in its infancy. Com-



Fig. 36.

Wisconsin Geological Survey.

Little Kaukauna Dam. Lower Fox river.

panies are now being formed to develop reservoirs and construct dams for water power that will greatly increase the present output of manufactured goods.

Manufacturing. A number of manufacturing plants, utilizing the water power, are located on the Wisconsin river. The following are the most important:

<i>Location.</i>	<i>No. horse power.</i>	<i>Uses.</i>
Prairie du Sac (G 14) .small amt.		
Kilbourn (G 13).....	8,000	Electricity in Milwaukee.
Nekoosa (G 10).....	4,650	Paper and pulp mill.
Port Edwards (F 9)....	3,860	Paper and pulp.
South Centralia (G 10)..	1,460	Paper and pulp.
Grand Rapids (G 10)....	6,500	Paper, flour, machinery.
Stevens Point (H 10)...	6,170	Paper, flour and feed.
Wausau (H 8).....	1,800	Grain milling, electricity, lumber.
Brokaw (H 8).....	4,000	Paper and pulp.
Merrill (G 7).....	3,150	Paper, flour.
Tomahawk (G 7).....	650	Paper.
Rhineland (H 6).....	3,000	Paper and pulp.



Fig. 37.

Paper Mill at Grand Rapids, Power from Wisconsin River.

Besides these powers on the main river, there are many water powers on the tributaries, ranging from 25 to 200 and in one case over 500 horse power, used for the grinding of flour and feed, electric light and power, woolen mills, saw mills and a graphite mill.

Water Powers of the Rock River System. The average slope of the bed of Rock river (K 14) is very small but there are a few rapids over hard strata of rock that render water power possible and most of these have been developed. The principal ones are given below:

<i>City.</i>	<i>No.</i> <i>horse power.</i>	<i>Uses.</i>
Watertown (L 14) (in upper dam).....	225	Electric light, flour, bee hives and boxes, brushes.
Jefferson (K 14).....	150	Flour and woolen mills.
Janesville (J 15).....	1,500	Electric light and power, woolen and flour mills.
Beloit (J 16) ..considerable amt.		Machinery, electric light, planing mills, water works, knife works, flour.

Tributaries of the Rock River. Some notable water powers are developed on the tributaries of the Rock river. The most important of these are located on Catfish and Beaver Dam rivers, but several considerable powers are on smaller streams. A few of the principal ones are given:



Fig. 38.

Wisconsin Geological Survey.

Dam at Nakoosa Paper Co., Wisconsin River.

<i>City.</i>	<i>Stream.</i>	<i>Uses.</i>
Beaver Dam (J 13)...	Beaver Dam river.	Cotton and woolen mills.
Fulton (J 15).....	Catfish river	Electric light.
Dunkirk	Catfish river	Electric light.
Brodhead (H 16).....	Sugar river.	Flour, light, plows.
Albany (H 15).....	Little Sugar river.	Grist mill, woolen mill.
Darlington (F 15).....	Pecatonica	Elec. light, button factory.
Mayville (K 13).....	E. Br. Rock river.	Iron works.

Water Powers of the Green Bay Tributaries. The rivers of Green bay have great water power possibilities, but until recently this power has received little attention. Several important powers are now in use.

<i>City.</i>	<i>Stream.</i>	<i>Uses of the Power.</i>
Grand Rapids (Falls) ..	Menominee	Power transmitted to Menominee and Marinette.
Marinette (M 8)	Menominee	Paper mills, lumber mills.
Little Quinnesec	Menominee	Paper and pulp mills.
Peshtigo (M 8)	Peshtigo	Saw mill, flour mill.
High Falls and Johnson Falls	Peshtigo	Power transmitted to Green Bay.
Oconto Falls (L 7)	Oconto	Paper and pulp mills.

Water Powers of Lake Michigan Basin. While the rivers that flow into Lake Michigan from the west are short and small, the descent is irregular over glacial debris and limestone rocks so that a number of small water powers have been developed. Following are some of the most important:

<i>City.</i>	<i>Stream.</i>	<i>Uses of the Power.</i>
Thiensville (L 14)	Milwaukee	Flour and grist mill.
Cedarburg (L 14)	Cedar (Milwaukee) ..	Flour and woolen mills.
Sheboygan Falls (M 12)	Sheboygan	Woolen mills.
Waldo (L 12)	Sheboygan	Flour and feed.

Black River. Not many water powers have been found and developed on Black river. Its source is in the terminal moraine but the slope is small and the banks so wide, especially in the lower part, that water power is impractical. Some of the developed powers are as follows:

<i>City.</i>	<i>No. horse power.</i>	<i>Uses.</i>
Hatfield (E 10)	Electricity to LaCrosse.
Black River Falls (E 10)	345	Electric light, sash and doors, wagons, grist mill.
Galesville (Beaver Creek) (D 11)	150	Electric light, flour.

Water Powers of the Chippewa River. The Chippewa has a great many lakes and abundance of forests in the

upper part of its system and also a number of rapids and falls. These conditions are favorable to water powers and a number of important ones have been developed. The following list will give some idea of the manufacturing along this stream:

<i>City.</i>	<i>No. horse power.</i>	<i>Uses.</i>
Eau Claire (C 9).....	8,246	Paper, electric lights and power water works.
Chippewa Falls (D 8)...	1,000	Saw mill, water works, electric light and more
Davis Falls	Paper.

Tributaries of the Chippewa River. The tributaries of the Chippewa river, like the river itself, have great possibilities of water power, but as yet little development has been done except for logging and saw mills. The following are the most important:

<i>City.</i>	<i>Stream.</i>	<i>Uses.</i>
Ladysmith (D 7).....	Flambeau	Paper, woodenware.
Park Falls (F 5).....	Flambeau	Paper.
Menominee (B 8).....	Red Cedar.....	Electric power.
Eau Claire (C 9).....	Eau Claire.....	Linen mill, saw mill, mchy. Linen mill, saw mill, machinery.
Chippewa Falls (D 8)...	Duncan Creek.....	Shoes, flour.

Water Powers of the St. Croix River System. This river lies almost wholly in the terminal moraine of the ancient glacier and hence has lakes and marshes near its source. Its principal water power is at the St. Croix falls, where the river flows from the hard Keweenawan lava beds to the Cambrian sandstone. The following list enumerates the principal developed powers of the St. Croix and its tributaries:

<i>City.</i>	<i>Stream.</i>	<i>Uses.</i>
St. Croix Falls (A 7)...	St. Croix river.....	Electric power in Minneapolis.
New Richmond (A 8)...	(Water on Apple river)	Lights, flour mills and elevator at New Richmond.
New Richmond (A 8)...	Willow river	Flour mills.
Hudson (A 8).....	Willow river	Electric light.

Water Powers of the Lake Superior Basin. The rivers flowing into the lake from Wisconsin are short and have considerable slope. The steepest part is on the line of contact of the Keweenawan lava beds with the Superior sandstone. This gives good opportunities for water power but the development has been slow.

On the St. Louis river (A 2), about two miles beyond the boundary of the state, is one of the largest water powers of the country. By the construction of a dam above the rapids of the river, a fall of 345 feet has been secured, producing 30,000 horse power. The electric power is transmitted to Superior (B 3) and used for lighting, for running street cars and for driving machinery of many kinds.

CHAPTER IX.

SOILS AND GROUND WATER.

The most important part of the surface of our state is a thin layer known as the soil. It is found in all places where vegetation grows and varies in thickness from a few inches to several feet. It is constantly being destroyed by the erosive action of water and the absorption of plants, and is replaced by the crumbling of rocks and the decay of plants. The texture of the soil depends upon the amount of sand and loose material compared with the finer grains of clay and humus. The coarser the texture, the more easily the water will flow through the soil particles and the more readily it is furnished to growing vegetation. The fertility of any region depends upon the texture as well as the plant food contained in the soil.

The Glacial Soils. The soils of the glaciated region, which occupies a large portion of the state, (See Fig. 10) are composed of a mixture of sand, clay and gravel with a thin layer of humus on top. Having been formed by the grinding and shoveling action of glaciers, these soils vary widely in character, although they partake in a general way of the nature of the rock beneath them. (See soil map, Fig. 39.) The glacial soils are, as a rule, coarse in texture and allow water to circulate freely, making them good for grasses and general farming.

Alluvial Soils. These soils are found in the valleys of rivers, along the lake shores, and at certain places where they were deposited in front of the retreating ice sheet. They are finer in texture than glacial soils and are richer

in plant food. The deposits exposed by the rising of the shores of Lakes Michigan and Superior are mostly red clays and are very fertile when the texture is loosened by cultivation. The rivers of many parts of the state, especially of the western and southwestern parts, have terraces of alluvial deposits made when the rivers were at a higher level, most of them at the retreat of the glacial ice. (See Fig. 30.)

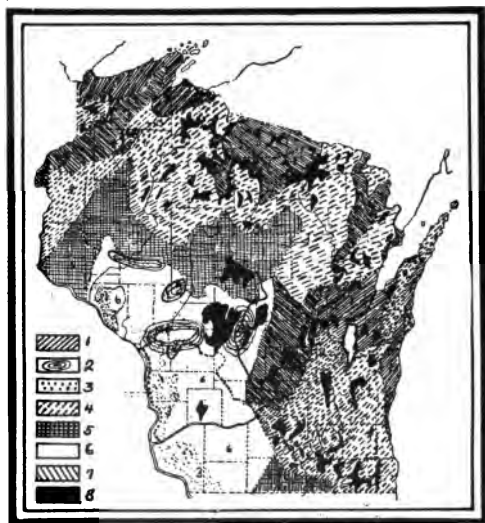


Fig. 39.

Wisconsin Geological Survey.

Soils of Wisconsin. 1. Red Clay, Chiefly Lacustrine Origin. 2. Residual Sandy Soils of Potsdam Sandstone. 3. Loess. 4. Last Glacial Clay on Limestone, Sandstone and Crystalline Rocks. 5. Old Glacial Clay on Limestone, Sandstone and Crystalline Rocks. 6. Residual Sandy Loam and Glacial Clay. 7. Sandy Soils of Last Glacial Period. 8. Muck and Peat.

Sandy Soil of the Interior. There is much sandy soil in the state. As a rule, such soils contain 15% to 20% of clay and humus and allow the water to circulate freely. On account of the rapid absorption and radiation of

heat, the sandy soils become warm early in the spring and hot in the summer, causing a rapid growth of vegetation if rainfall is sufficient.

In the Sandstone area in the central and western parts of the state, the sandy soil comes from the crumbling of the Potsdam and other sandstones, while in the northern and eastern parts the sand was scattered and mixed with other soils by the movement of the glaciers. (See soil map, Fig. 39.)

Limestone Soils. In the southwestern part of the state the limy clay soils are made by the decay of the lime-



Fig. 40.

Field Work at Normal School, River Falls. Testing Soils and Planting.

stone beneath. These soils are fertile, as is shown by the maps of the productive areas. (See Figs. 59-70.) In the eastern and southeastern parts the limy clay is more or less mixed with glacial drift, making a soil more porous but none the less fertile. (See soil map and maps of productive areas, Figs. 39, 59-70.)

It is not possible to consider in a small book the minor divisions of soils. It is enough for us to know the general divisions and the relative value of each, as shown by the

maps of the productive areas. The muck or peat areas have several feet of vegetation which fell down in water and was preserved from complete decay. In places where the peat is in good condition it may be used for fuel, but where the layer of vegetation is somewhat mixed with sand or is more decayed, it makes an extremely rich soil. In this way many of the beds of former shallow lakes have become very rich and fertile fields.

Ground Water. A large portion of the water that falls in Wisconsin sinks beneath the surface and circulates as ground water. The amount of water beyond that which is required to moisten the soil moves downward until it reaches an impervious layer and moves along its surface. The quantity that sinks into the soil depends upon the slope of the land and the texture, more going down into sandy soils than into clay. As this ground water moves slowly through the soil, some of it is taken up by the plants, some of it comes to the surface as springs and some of it follows the downward sloping layers of rocks into greater depths. Much of it collects into small streams underground, which are called veins.

Springs. Springs are very common in Wisconsin. There are thousands of them in the state and some of them are quite well known. They are found in places where the ground water comes to the surface on the hill sides or in low levels, and they furnish much of the water that runs in the streams of the state in times of dry weather. The water in springs is generally pure and wholesome and some springs in the state have medicinal properties that attract many people in search of health.

Wells. In places where there are no springs, wells are bored or dug down below the level of ground water. A basin is thus made in the ground into which the water collects and from which it may be lifted to the surface as needed. In many places the ground water is near the

surface and wells may be made at small cost, but in other places, where the impervious layer is near the surface, water is reached only by hundreds of feet of expensive boring. Fortunately for the farmer, such places are not common in Wisconsin.



Fig. 41.

Artesian Well at Prairie du Chien.

Artesian Wells. Always deeper than ordinary wells, these often reach a great depth. They are bored with a drill or well auger and are encased in an iron pipe, which prevents foreign substances from entering the well. In order to understand artesian wells we must know something of the structure of the rocks under the surface.

When layers of rock incline downward under the surface the ground water follows down the layers of permeable rock, such as sandstone, until it can go no farther, owing to a wall of impermeable rock or an upward bend in the rock layers. If there is an impermeable layer of rock, such as shale or limestone, above and below the sandstone, the water will fill the sandstone layer up to the surface as though it were a water-tight box. When a hole is dug down



Fig. 42.

Wisconsin Geological Survey.

Artesian Well at Auroraville.

to the water layer, the water will rise in the well and sometimes high in the air. (See Fig. 41.)

Artesian wells are very common in central and southern Wisconsin, where the Potsdam sandstone dips under the limestone. Wells from the same sandstone layer, but at greater depth, are found in Illinois and Iowa.

Importance of Good Water. Good water is conducive to health and prosperity. The importance of a sufficient supply of pure, fresh water to a stock raising and dairy district like Wisconsin cannot be overestimated. No area in America has a better water supply than our state, a fact that has had much to do with placing Wisconsin in the front rank among the states in the production of livestock and dairy products.

CHAPTER X.

MINES AND MINERALS OF WISCONSIN.

Our state has many mineral deposits which have become sources of revenue. By referring to the mineral map (Fig. 43) the deposits of iron, zinc, lead and copper may be located. Of almost equal value, however, are the building stones and clays which are found in many parts of the state.

The Formation of Ores. Ores are minerals containing valuable metals. They are more or less mixed with the rocks of the earth and the story of their formation is interesting and instructive. Ores did not exist in their present forms at first, but have been brought together in various ways. Some are of volcanic origin and have been injected into their present positions from vapors and liquids issuing from molten lavas. Some ores are deposited in water, either from organisms, chemical precipitates or sediments, and are of sedimentary origin. Other ores may be formed by underground water, which dissolves the minute particles of mineral distributed in many of the common rocks and carries the solution to places where it is concentrated into veins. Many ores are formed by combinations of these processes. Ores of igneous origin, such as gold, silver, copper and lead, are often locally enriched by means of the circulating ground water which carries mineral matter in solution around through the rock and deposits it in favorable places.

Iron Deposits of Wisconsin. In the Huronian rocks which bound the Granite area on the north and west are

several sedimentary series containing quartzites and slates in which iron ore has been found in many places. The rocks containing the iron deposits form a range of hills known as the Penoque-Gogebic range. Many mines have been developed in this range and more are being opened every year. Nearly all of the ore is shipped to Ashland (E. 3), where a small portion is smelted at the Ashland furnaces and the remainder sent down the lakes. In the Baraboo Ridge similar deposits are found in Huronian

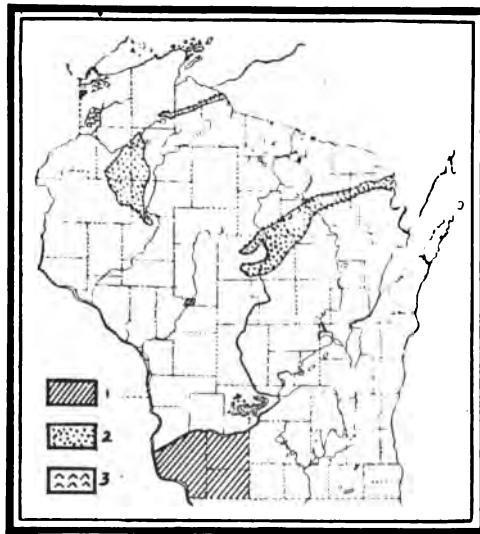


Fig. 43.

Wisconsin Geological Survey.

Mineral Map of Wisconsin. 1. Lead. 2. Iron. 3. Copper.

rocks, while in Dodge county, iron deposits are found in the Silurian limestone.

The first iron mining in Wisconsin was at Iron Ridge (K 13) in Dodge county. Mining of iron was begun at Hurley (F 4) in 1891 and the output has been increasing

ever since that time. Marketable iron was discovered at Baraboo ridge in 1900 and mining has been carried on since by corporations having furnaces in Milwaukee and Chicago.

Iron Mining. The bodies of iron ore are usually found at some depth under the surface, and the ore is car-

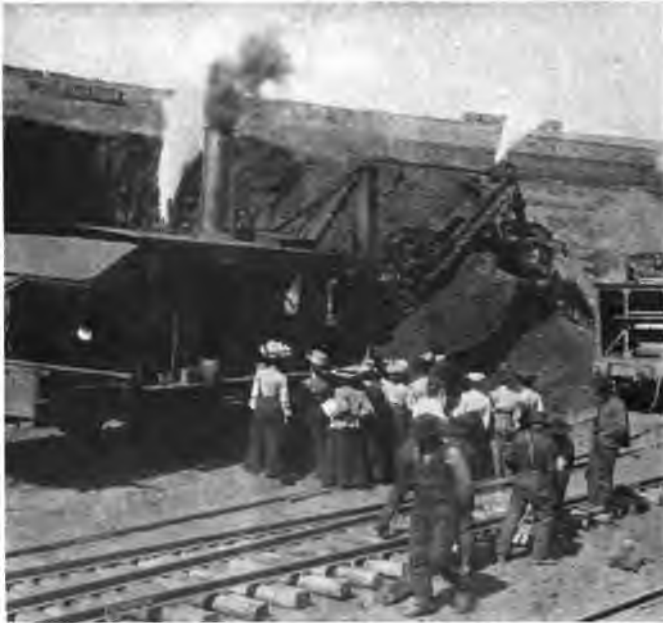


Fig. 44.

Class from Normal School, Superior, at an Iron Mine. Shows Method of Mining and Loading the Ore That is Shipped From the Docks in Superior.

ried out through shafts. A shaft is an opening not smaller than five feet by eight feet in size, sunken from the surface to the ore body. From this shaft tunnels called drifts are made into the ore or along by the side of it. The ore in the tunnels is blasted out from the side or top and is

collected and taken up the shaft to be dumped into cars and taken to the smelter or to the lake ports.

'Smelting of Iron. The largest iron smelters in the state are located at Ashland and Milwaukee (M 14). The ore is put into the top of an upright furnace, where it is mixed with coke or charcoal and limestone, a draft of hot air being forced in at the bottom. In this way an intense



Fig. 45.

Iron Furnace at Ashland, Where Iron Ore Is Reduced to Pig Iron.
The Fuel Used Is Charcoal.

heat is produced, which melts everything in the furnace. The iron being heavier than the slag, sinks to the bottom and is drawn off below, while the impurities of the iron and the coke and limestone are carried off in the slag from a higher opening. The iron thus made is called pig iron and may be afterwards made into wrought iron or steel.

Lead and Zinc Deposits of Wisconsin. Long before the white man had set foot on Wisconsin soil, the Indians had discovered a peculiar, soft mineral in the southwestern part of the state. When the white man saw it he recognized it as the coveted lead, so useful in hunting and in war, and at once began to search for it. The ore masses are generally found in the limestone in that region. The lead and zinc are combined with sulphur, generally, and are called sulphides, though carbonates and silicates are also found. When both lead and zinc are found in the same mine, the lead is at the top and the zinc at the bottom. Many of the old mines were abandoned when the lead was exhausted.



Fig. 46.

Zinc Mine at Platteville, Showing the Shaft House and Dump of Waste. The Ore is Shipped to the Smelter.

The Mining of Lead and Zinc. The ore bodies are found by prospecting. Men who understand the work bore holes in the rocks with drills in favorable places, and if ore is found they try, by boring other holes, to find out if there is enough ore present to make a mine. Where large

bodies exist shafts are sunk, as in iron mining, and ore is brought to the surface. It is taken first to the concentrator, where it is crushed and much of the impurities are removed and afterward it goes to the smelter. The process of smelting these ores is similar to that of smelting iron.

Uses of Lead and Zinc. Formerly lead was used principally in the making of ammunition, but it is not used so much for that now. Great quantities of it are used for making paints, for storage batteries, for lead pipes and in many other ways in the arts. Zinc was formerly supposed to be almost worthless and was disregarded in mining lead, but it is now considered a valuable metal. It is used for galvanizing wire or sheets of iron; it is mixed with copper for making brass; it is used also in making sheet zinc, and with lead in the manufacture of paints.

Other Important Minerals. Copper is known to exist in the Keweenawan lava flow in the northern part of the state, but has not yet been successfully mined. Gold and diamonds have been found in the drift and are supposed to have been brought by the glaciers from Canada. Graphite is found in small quantities near Stevens Point.

Building Stones of Wisconsin. Many building stones of the highest quality are found in the state. Some of these have been quarried for a number of years, but activity in this line of business has greatly increased in recent years.

The Granite Industry. In many places in the state in the Granite area are outcrops of a high grade of granite. Owing to the durability of the granite, and the fact that it weathers and changes color so little, it is in great demand for permanent buildings, foundations, monuments and memorials of all kinds. Wisconsin granite varies in color from deep red to white or gray, takes a high polish and is ranked high in the markets of the country. A most important economic use of granite is for

road material, such as paving blocks and macadam. Granite paving blocks are similar in shape to common bricks, though larger, and are laid in cement in the street so as to make a very durable pavement for large cities. In some years the granite paving block industry of Wisconsin exceeds that of any other state in the Union. The principal quarries for paving blocks are at Berlin (J 11), Red Granite (J 11) and Montello (H 12). Granite is also quarried and prepared for use at Wausau, Amberg (L 6), Marinette and other places.

Limestone Industry. In the limestone regions of the eastern and southern parts of the state, beds of limestone often occur near the surface. When uniform in thickness and texture, it makes fine building stone. The best grade takes a high polish and is used for interior decoration. Limestone is often crushed like granite and used for macadam for roads and streets, the Niagara limestone being best for that purpose. The quarries are so abundant that it is not possible to name all of them. Important quarries are found at Lannon (L 14), Wauwautosa (L 14), Peebles (L 12), Sturgeon Bay (N 8), Waukesha (L 14), La Crosse (D 12) and Racine (M 15).

The Lime Industry. In a number of places in the state the limestone is so nearly pure that it is used for the manufacture of lime. The stone, which consists of lime, carbonic acid gas and impurities, is burned in an open furnace, driving off the gas and leaving the lime and impurities. After removing the impurities, which are picked out by hand, the lime is packed in barrels and is ready for the market. Lime is manufactured from stone quarried in many places in the Limestone area. (See Fig. 6.)

Portland Cement is a certain mixture of lime and clay that has the property of setting or hardening under water. Only limestone that contains a very small amount of mag-

nesia will do this, and hence, a lime that may be used for Portland cement is rare. Such rock is found in the Devonian limestone near Milwaukee and is used extensively for this purpose. The mixing of cement, sand and gravel in making building blocks, foundations and sidewalks is a process familiar to most children.

Sandstone. The Potsdam sandstone, suitable for building purposes, occurs in many parts of the United States, but in no place is it better represented than in Wisconsin. It occupies a broad belt south of the Granite Area and is also found in the Lake Superior coastal plain, where it is called Superior sandstone. The color of this sandstone varies from red to gray and it long withstands the destructive effects of the weather. It is not difficult to work and is one of the most popular building stones. Extensive quarries of it are found at Port Wing (D 2) and Washburn (E 3), on the lake shore, and at Dunville (B 9), Colfax (C 8), Grand Rapids, Baraboo (G 13) and Ableman.

Clay—The Brick Industry. The clays of our state constitute one of its most valuable natural resources. Besides forming the subsoil of all of the best farming land, they are also used for manufacturing purposes. Clays were formed by the decay of crystalline rocks, especially of granite, and were deposited in their present positions by running water, by the continental glacier, or by the drifting action of wind.

Bricks are made from clay. Deposits of uniform texture and containing the proper ingredients are selected, the clay is ground to mix it thoroughly, and it is then pressed into moulds, partly dried in the open air, then piled in the kilns and burned at a high temperature for the purpose of hardening and glazing it. The bricks of Wisconsin are of good quality and have an extensive use in the state. A few of the most important factories are located at Kenosha (N 16), Menominee, Milwaukee, Ra-

cine, Green Bay, Manitowoc (N 11) and Sheboygan (M 12) and De Pere.

Peat. Peat is formed in swamps where the growth of vegetation is dense and vigorous. When the vegetation dies or falls down for other reasons, it sinks under the water, where it is kept from the decay that would result if it



Fig. 47.

Wisconsin Geological Survey.

Making Brick at DePere.

should fall on the ground. Accumulations of this deposit for centuries, becoming denser as time goes on, are called peat, and this process is the first step in the formation of coal. Peat deposits are numerous in Wisconsin on account of the many shallow lakes, formed by glacial action, which are slowly filling up. Not much use is made of Wisconsin peat now, but it is used in other countries for fuel and is supposed to have great possibilities in this state.

CHAPTER XI.

INDUSTRIAL DEVELOPMENT OF WISCONSIN.

Why the Pioneer Came to Wisconsin. The region of Wisconsin has always been a highly prized territory. First its fur-bearing animals, then its mineral wealth, finally its native vegetation and soils were recognized and sought. The French desired it chiefly because it furnished a water route between the lower St. Lawrence and the lower Mississippi rivers. The English perhaps never realized its value, while the early Americans came because of its splendid soil and climate.

The Fur Trade. The Indians were the first collectors of furs, which to them were both clothing and ornament. The French traders followed the discoveries of Radisson (Rād'is son) and Groseillers (Grös il'ers) in 1656. The most highly prized furs were those of the buffalo, beaver, fox, sable, lynx, mink, wolf, and bear. They were procured by trapping, hunting and snaring. The French domination in the fur industry gave way to that of the English and finally the company formed by John Jacob Astor, an American, took over the fur trade of Wisconsin and conducted it as long as it was profitable.

The Lead Mines. The Indians were the first miners of lead in Wisconsin. The white men became acquainted with the mines through the Indians and mining was carried on by them in a way almost as crude as the methods of the Indians. Spanish and English in turn worked these lead deposits, and during the Revolutionary

War Americans doubtless obtained there a small quantity of lead.

In the first decade of the nineteenth century the mines began to be worked in earnest and a great rush of prospectors from all over the eastern part of the United States resulted. Smelters were erected and lead mining became very profitable. As the mines were sunken deeper the lead ore gave way to zinc, which was not at that time considered valuable. Hence, the mines declined until the revival of zinc mining in about 1900. The mining of zinc in the southwestern part of Wisconsin is now one of the profitable industries of the state.

The Growth of Milwaukee. Milwaukee was first established as a trading post by the French fur traders, probably in about 1795. In 1820 the town was but a small village, with but few interests outside of fur trading. An influx of American farmers and traders began about this time and Milwaukee became a market for the products of the surrounding region, including lead from the southwestern part of the state, which was shipped down the lakes eastward. From 1830 to 1850 the ore trade increased enormously and the ore roads to Milwaukee became prominent development factors, as they encouraged the growth of farms along their route and furnished outlets to markets in Milwaukee and Eastern states.

In 1838 the Germans began to arrive in Milwaukee from Germany, whence they had been driven by political persecution. This stream of immigrants continued for fifty years, resulting in the development of Milwaukee from the products of the forests, farms, quarries and mines.

Milwaukee is a great city, with a population in 1910 over three hundred and seventy thousand people, and shows plainly the growth of a small town from the up-building of the surrounding country.

The Building of Railroads. The first railroad in Wisconsin was begun in Milwaukee and reached Prairie du Chien (D 14) in 1857. This was built to revive the lead trade, but although it failed in this, it developed an immensely rich farming country. Other roads connecting the east and west and the north and south soon followed, and each contributed its share to the progress of



Fig. 48.

Dairy Barn Herd, Agricultural Department, State University.

the state. The canals, built at great expense along the old water route, utterly failed and fell into disuse when the railroads were built. The two roads of greatest importance were the Chicago and Northwestern and the Chicago, Milwaukee and St. Paul.

The Effect of the Civil War. During the war between the North and South, Wisconsin furnished its quota of soldiers to the Northern army. However, since

the state was in such an immature condition, the withdrawal of so many laborers almost paralyzed progress until the war closed. The outlet of commerce through the South was stopped, while the South held the mouth of the Mississippi river. The trade through the Great Lakes route increased, however, and on the whole some progress was made.

After the war closed the government made liberal grants of land to old soldiers and as a result there was a great movement of soldiers to Wisconsin. Naturally intelligent and courageous, the years of military service had been an education to these men, and their settlement in the state has been of great value to its growth and progress.

The Lumber Industry. Lumbering has done much for Wisconsin. By referring to the vegetation map (See Fig. 50) it may be easily seen that the forests of hardwood and pine covered most of the state. In the first year of the territory lumbering began and saw-mills were built as early as 1819 at Green Bay and on the rivers of the eastern part of the territory a few years later. The rivers of the state are peculiarly adapted to this business. On the east the Wolf and Fox rivers lead to Green bay, and on the south and west the Rock, the Wisconsin, the Black, and the St. Croix rivers lead to the Mississippi. All these rivers are swift, easily permitting the floating of logs and the running of saw-mills by water power. From the east side, lumber was shipped to New York and eastern points, while from the other parts of the state lumber was sent on rafts to the towns along the Mississippi as far south as Arkansas.

The industry reached its zenith between 1870 and 1880 and is now on the decline because so much of the forest-covered land has been cut over. The lumber industry was instrumental in bringing many people from the



Fig. 49.
Horticultural Grounds of the State University.

northeastern part of the United States, from Canada and also from Norway, into the state where they could pursue the same kind of work they had learned at home. Many towns, especially in the central and northern parts of the state, were started as logging camps, and some of them afterwards developed into rapidly growing industrial centers.

Tobacco. The raising of tobacco in the state dates back to the territorial days when it was probably begun by settlers coming from farther south. During the Civil War and the few years following, it was stimulated by the fact that the supply from Virginia and other Southern states was greatly diminished. The soil and climate favored the raising of a fine quality of tobacco and the industry has since become one of the most important in the state.

Industrial Adjustment. An interesting feature about the geography of Wisconsin is its constant adaptation of the natural products to the needs of the hour. The rise of Milwaukee as the nearest lake point to the lead mines, the development of lumbering along the swift streams, the manufacture of cotton along the Rock river by water power, the raising of tobacco during the Civil War, all illustrate how quickly the people have adapted themselves to the situation. Nearly all of the cities in central and northern Wisconsin were established as saw-mills with the necessary stores and shops to contribute to the success of the enterprise. As the lumbering industry was exhausted, these towns developed into thriving villages and often into cities by the rising of new industries.

Milwaukee, being the metropolis, naturally furnished machinery to the saw-mills and mining camps, and from this small beginning has become the greatest center for saw-mill and mining machinery in the world. The deposits of glacial clay have been used for making brick and tiling. The great hemlock forests and the packing houses in Mil-

waukee have given rise to extensive tanneries where leather of all kinds is manufactured.

The old grist mills on the water power sites have become flourishing feed mills and in some cases flour mills.

In a similar way have arisen the canning factories in many cities, iron smelting in Ashland, factories for agricultural implements at LaCrosse and Racine, woolen mills and knitting factories in the southeastern part of the state, and sugar factories in certain counties to encourage the growing of sugar beets.

Immigration. Few states contain a greater variety of peoples and nationalities than Wisconsin. From time to time hordes of people have swarmed into the state, attracted by the productiveness of the land and the opportunity offered the industrious individual.

The Germans constitute the most numerous foreign element. They first came to escape persecution in Germany and to follow out their own ideas in the land of liberty. With these early immigrants came Carl Schurz, who was exiled from his home in Germany in 1848. He made his home first in Wisconsin and afterwards became one of the foremost statesmen of the country. The Germans are found in all parts of the state but are most numerous in and around Milwaukee. They have added greatly to the intelligence and prosperity of the state.

Immigration from Scandinavia has also been heavy and many of the most prominent public men in the state have descended from one or another of these great nationalities. The Norwegians and Danes, as a rule, are most numerous in the southern part of the state, in Dane and neighboring counties, the Swedes being more numerous in northern and northeastern counties. The Scandinavians have done much for the dairy industry in all parts of the state and are also well represented in all of the other industries.

Besides, thousands of the most progressive and highly

respected citizens have come from central and southern Europe, and from Canada, while the eastern and central states of our own country are well represented in all parts of the state.

CHAPTER XII.

PRINCIPAL INDUSTRIES OF WISCONSIN.

Our state has many industries. The native forests, clays, building stones, lime and cement producing stones, and

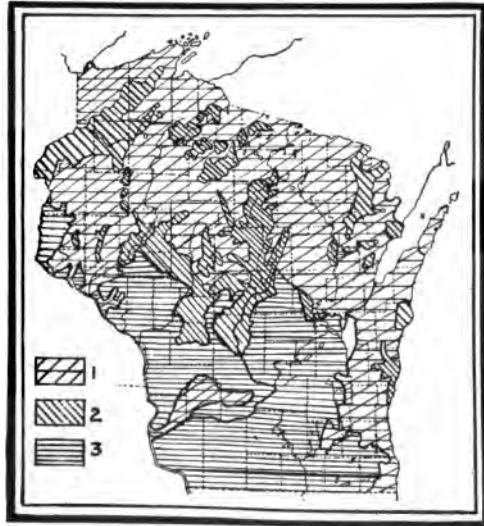


Fig. 50.

Wisconsin Geological Survey.

Original Forests of the State. This Map Easily Locates the Lumbering Districts. 1. Soft Maple and Mixed Hardwood—Oak, Maple, Birch and Evergreen (the Latter Mainly Pine, Hemlock and Balsam). 2. Pine (Including so-called "Barrens") and Dwarf Oak. 3. Oak Group.

ores of lead, zinc and iron have for many years been the basis of important industries. Soils of various kinds and a



Fig. 51.

Logging in a Forest in Northern Wisconsin.

climate well adapted to the raising of agricultural products of the north temperate zone, give rise to industries connected with agriculture, stock raising and dairying. The presence of a good supply of water power has stimulated the growth of many lines of manufacturing. The transportation necessary for the exchange of all articles of commerce produced in the state or needed in it has grown to be a most important industry.

Several of these industries are discussed under the chapter on Mines and Minerals; others will be here considered.



Fig. 52.

Photo by J. M. McCabe.

A Load of Logs.

Hauled on Iced Roads. 25,000 Feet of Logs are Drawn by Four Horses.

The Forest Industries. Much of Wisconsin was formerly covered with valuable forests. (See map, Fig. 50.) The cutting of these forests began early in the history of the state and has remained one of the principal industries. Logging is the first step. The trees are felled, usually in the winter, and cut into the required lengths for sawing. White and Norway pine, spruce, hemlock, cedar, tamarack, birch, maple and oak are the principal woods used for lumber; spruce, hemlock and poplar are used for making

paper; cedar for shingles, posts and poles and tamarack for poles. After the trees are cut the logs are hauled to the river or railroad on sleds, often on roads that have been flooded with water to coat them with ice.

Saw mills are generally located on streams where water power may be obtained, though often steam is used to supplement water power or where such power is not obtainable.



Fig. 53.

Interior of One of the Largest Saw Mills of Wisconsin, Chippewa Falls.

Logs are floated down the stream or carried by rail to the saw-mill, where they are made into boards, studding, or any other mill product desired. Saw mills are complex systems of machinery ranging in size from the small portable mill and engine to the mammoth plant that is capable of cutting millions of feet annually. Planing mills are used for pre-

paring the lumber for fine work and are often found in connection with the saw mills. Doors, sash, frames, moldings and other interior finishings are made from lumber that has been planed and allowed to dry. Large mills for interior finish are located at Oshkosh (K 11), Wausau, Appleton, Milwaukee, Fond du Lac (K 12), and many other places in the state.



Fig. 54.

Chair Factory at Sheboygan. One of the Largest in the Country.

Veneer is a thin layer of wood. Such varieties as birch, oak or maple and others which take a high polish are used for veneer. It is made by revolving a log against a long, sharp knife, cutting the entire log into a sheet about one-eighth to one-twelfth, or even one-one hundred and sixtieth, of an inch thick. Veneer glued to soft wood, such as pine, is used to make doors, frames and all kinds of interior finish. Wisconsin birch is called "American mahogany." Important veneer mills are located at Oshkosh, Sheboygan, Glidden and at other places in the northeastern part of the

state, and the product has an extensive sale all over the country.

Furniture making is a large industry in Wisconsin, as one would naturally infer from its lumber interests. Chairs, tables, desks, refrigerators and many other kinds of furniture are extensively manufactured and shipped to the west and southwest. The leading factories are at Sheboy-



Fig. 55.

Wooden Type Factory, Two Rivers. The Enormous Output of This Factory is Sent to all Parts of the Country.

gan, Oshkosh, Fond du Lac, Superior, Eau Claire and Kenosha, but numerous smaller factories are found in many parts of the state.

Paper making is one of the principal industries of the forest regions of the state. Hemlock and spruce are the principal woods used, but tamarack, poplar and other woods are also in demand. The wood is ground into pulp and softened in vats of water at different temperatures until it

is thoroughly reduced to a pulpy mass. It is then conveyed to rollers and pressed into firm paper and finally, by passing it over hot steel rollers, it is pressed into paper of the desired size and thickness. Wood is reduced to pulp also by soaking it in sulphurous acid. This is called the sulphite process of making paper. Paper mills are located in every city on the Upper Wisconsin and the Lower Fox rivers, a large number on the Chippewa river and many also on other rivers in the eastern part of the state. The output of the paper mills of Wisconsin in 1907 was about eighteen mil-



Fig. 56.

Tannery at Milwaukee. One of the Largest in the World.

lions of dollars, and it goes to supply the trade in all parts of the country.

Tanning is a very large and important industry of Wisconsin, and is connected with the raising of live stock as well as with the forest. The tanning fluid is made by grinding hemlock or white oak bark to powder and soaking it in boiling water. After the hair has been removed from the hides they are soaked in vats containing varying strengths of the tanning fluid until they are reduced to leather. The last step in the process of making ordinary

leather is taking the tanned hides from the vats and, after drying, running them through steam heated steel rollers; this produces the gloss usually seen on leather. Hides for this industry are obtained from live stock killed in the state, from Chicago, and from many other places, including South America and other foreign countries. Tanneries are located at Milwaukee, Fond du Lac, Kenosha, Wausau,



Fig. 57.

A Cornfield in Central Wisconsin.

Merrill, Mellen (E 4), and other places of lesser importance. Wisconsin is a large producer of leather, its output in 1907 being about thirty-nine millions of dollars. The products of these tanneries are shipped all over the world.

Agricultural Industries. The soil and climate of our state are so favorable to agriculture that industries of this nature will perhaps always be the most important in the

state. More people are engaged in these occupations than in all others and the income from the farms, gardens and orchards of the state is far greater than from all other sources combined.

Fruits. Fruit raising is important in many counties. Apples have been successfully grown for many years in the central and eastern parts, especially in the counties bordering on Lake Michigan. The counties bordering on Lake



Fig. 58.

Cranberry Marsh. The Close Oversight of the Weather Bureau Makes this Industry a Success.

Winnebago and Lake Superior also produce apples successfully. The influence of the lakes retards the spring blooms until the danger of late frosts is greatly reduced. The greatest crops in apples are found in Milwaukee, Manitowoc, Washington, Door, Sheboygan and Fond du Lac counties. Berries are found wild in all parts of the state and have been cultivated with profit in nearly all of the counties. Raspberries are grown in more counties, but

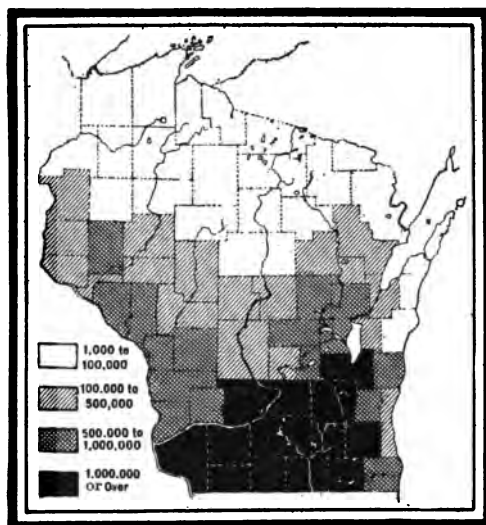


Fig. 59.
Bushels of Corn Produced per County.

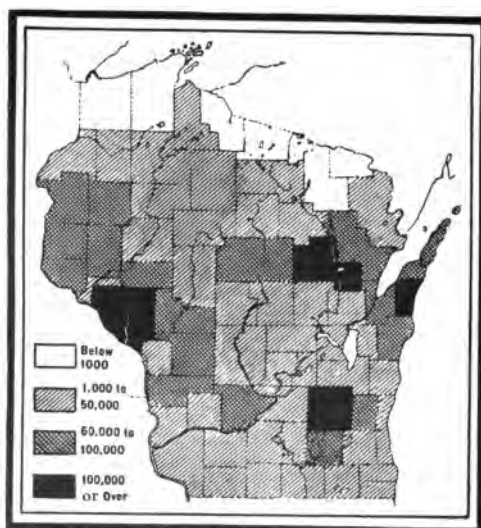


Fig. 60.
Bushels of Wheat Produced per County.

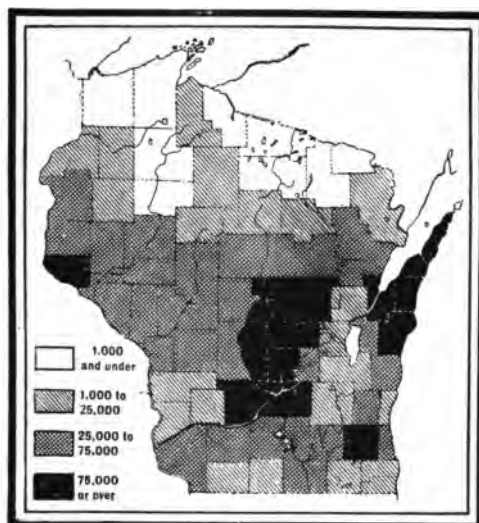


Fig. 61.
Bushels of Rye Produced per County.

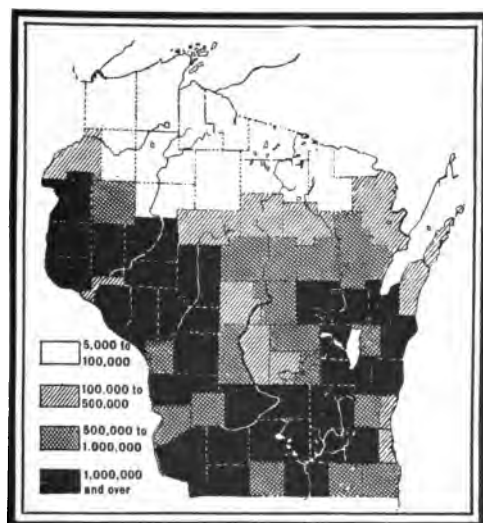


Fig. 62.
Bushels of Oats Produced per County.

grapes are produced in a greater quantity. Strawberries are grown in nearly all of the counties and currants are also a general crop. Famous cranberry marshes are found in Wood, Jackson, Monroe and Juneau counties, producing annually many thousands of bushels of cranberries.

Maps of *productive areas* are here given (See maps, Nos. 58 to 70) for the purpose of showing where each agricultural product is most profitable. As farming develops there will be some changes in these maps, especially in the northern half of the state, where the cultivation of the soil is yet in its infancy.



Fig. 63.

Harvesting Oats in Northwestern Wisconsin.

Corn, wheat and rye are staple food crops of the state and are raised extensively. (See maps 59, 60 and 61.) The average yield per acre of these crops in our state is considerably above the average for the United States and is almost as high as the highest. Flour mills are located in many places in the state, the largest centers being at La Crosse, Milwaukee and Superior.

The making of *beer* is a large industry in Wisconsin. The most important ingredient in beer is malt, which

consists of barley that has been sprouted and dried. Corn is also used after it has been deprived of the germ and ground into meal. The malt and corn are mixed and boiled for a time and the extract, in which the starch of the grains has been turned to sugar, is boiled with hops and cooled to the desired temperature. Yeast is afterward put in and the liquid is allowed to ferment ten or twelve days, after which cooling and filtering take place and the beer is ready for storage and use. The principal centers for



Fig. 64.

Threshing Wheat in Southern Wisconsin.

the manufacture of malt and beer are La Crosse, Milwaukee, Fond du Lac, Watertown, Manitowoc and Wausau.

Oats is an important crop in the state. (See map 62.) Wisconsin produces more oats to the acre than any other state, and in the total amount raised it is third among the states. *Barley* is an important crop in several counties.

Hay includes those grasses that are harvested while green, dried in the sun and stored for future use. The most common grasses, so used, are timothy, red clover, alsike,

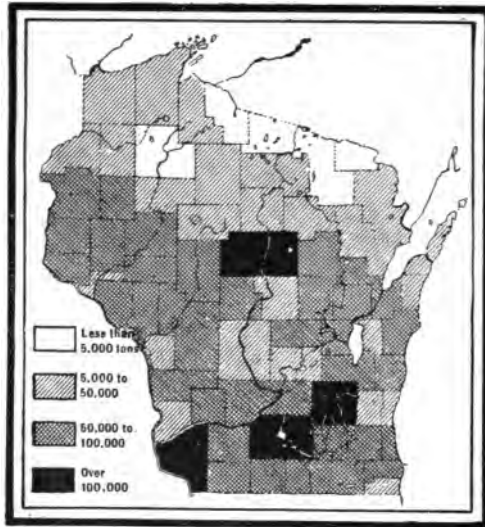


Fig. 65.
Tons of Hay Produced per County.

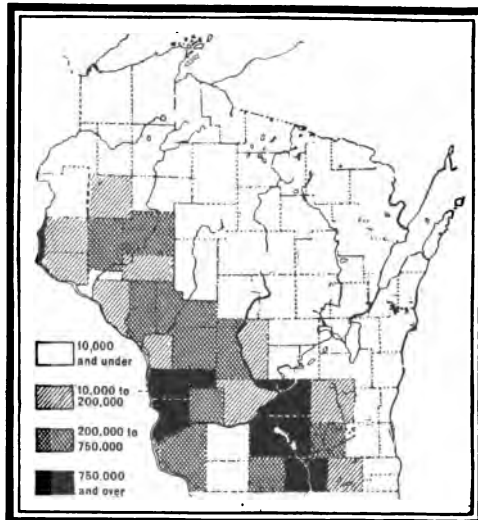


Fig. 66.
Pounds of Tobacco Produced per County.

alfalfa, blue stem and marsh grass. In the dairy regions of the state, hay is used extensively for forage, but so much of it is grown that it is put up in bales and shipped to local or general markets. In the central and northern parts of the state, where the soil and climate are well adapted to the growth of all kinds of grasses, hay is one of the most im-



Fig. 67.

Photo by Frank Dickson.

Tobacco Growing in Field. Dane County.

portant crops. The value of the hay crop in the state is more than two and one-half millions of dollars.

Tobacco has been for many years an important product of southern Wisconsin, but by referring to the map (Fig. 66) it may be seen that it is profitable in the northern counties also. The tobacco of our state has a desirable flavor and is used extensively for cigar wrappers. The

principal tobacco centers are Madison, Soldiers' Grove (E 13), Edgerton (J 15), Stoughton (J 15), Janesville and Viroqua (E 13).

Sugar Beets. The growing of sugar beets and manufacturing of beet sugar are new industries in Wisconsin, but have had a rapid growth. (See map 68.) A fine quality of sugar is made here and the industries connected with it

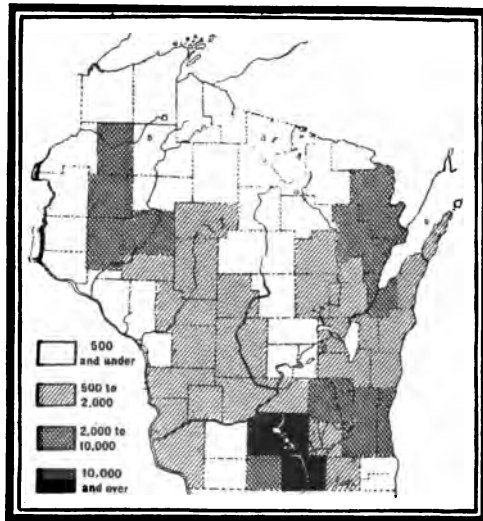


Fig. 68.

Tons of Sugar Beets Produced per County.

are extending to all parts of the state. The sugar beet is larger and lighter in color than the beet used for food, and it contains a larger percentage of sugar. When fully grown the tops are fed to stock and the beets are sent to the factory. The process of making sugar from sugar beets is hard to explain, but the plan is a simple one. The beets are cut into thin pieces and boiled in water until all of the

sugar is extracted. The water containing the sugar is then boiled down and bleached to a granular white sugar. The refuse or pulp forms a nourishing food for hogs or other live stock. Beet sugar factories are located at Janesville, Madison, Chippewa Falls and Marinette, and others are being erected.

Potatoes are grown successfully in many parts of the state, especially in the sandstone belt of the northern half.



Fig. 69.

Field of Sugar Beets. Chippewa County.

(See map 70.) This industry is increasing rapidly, as the soil is well adapted to the plant. Factories are located at several places in the state for the manufacture of starch from potatoes.

Vegetables are raised extensively in the central and eastern counties. From all of these counties great quantities are furnished to the local markets and to the markets of

Milwaukee and Chicago. The canning of peas, corn, beans and tomatoes is a large and rapidly increasing industry. Canning factories have been established at Waukesha, Sheboygan, Janesville, Manitowoc, Eau Claire, and at many other places in the state. Pickles are made in great quantities at Sparta (E 12). Onions and cabbages are grown in the southern part of the state and shipped to southern markets.

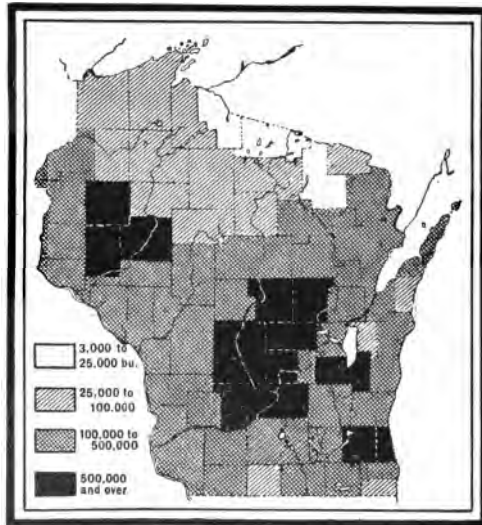


Fig. 70.

Bushels of Potatoes Produced per County.

Live Stock Industries. Wisconsin is almost in the center of the prairie region of the continent and is a successful producer of grasses and live stock. *Cattle* and *hogs* are important products in the southern parts of the state. The greatest number are found in counties producing the greatest amount of grass, corn and sugar beets, their favorite foods. When in condition for market, the fat cattle

and hogs are sent to Chicago, or to some of the slaughter house markets of Wisconsin. The principal packing houses of the state are located at Jefferson, Eau Claire and Cudahy (M 15), a suburb of Milwaukee. Much attention is given to the breeding of fine cattle in Wisconsin, especially to the kinds most valuable for dairy purposes. Holsteins, Jerseys, Guernseys and Ayrshires are the most popular breeds for this purpose. The raising of dairy cattle



Fig. 71.
Canning Factory at Rice Lake.

is just becoming a very extensive industry. The value of milch cows in 1900 was nearly \$25,000,000.

Sheep are raised extensively in several counties. The wool interests of the state are considerable. (See map 75.) The wool is taken to the mill and washed, combed and prepared for spinning. It is then made into yarn and sent to the knitting factories or twisted into threads and made into woollen cloth at the woollen mills. The most important of these are located at Beaver Dam, Chippewa

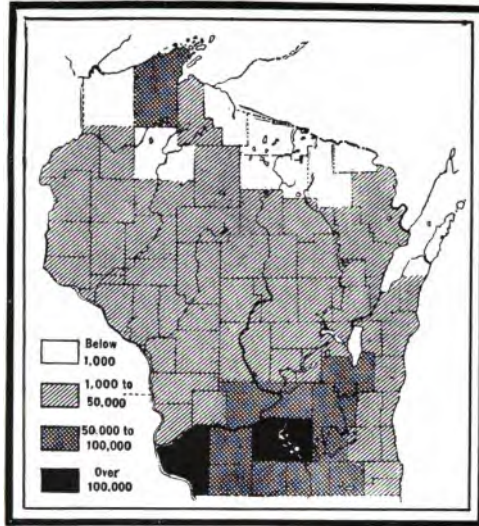


Fig. 72.
Number of Hogs Produced per County.



Fig. 73.
A Herd of Jerseys.



Fig. 74.
Scene in a Packing House, Milwaukee. Thousands of Cattle, Hogs
and Sheep are Prepared Daily for the Market.

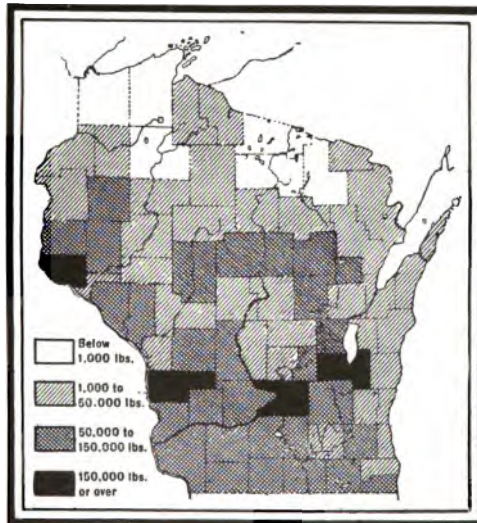


Fig. 75.
Pounds of Wool Produced per County.

Falls, Sheboygan Falls and Ripon (K 12), while knitting factories are located at Milwaukee, Kenosha, Sheboygan and Manitowoc. Sheep and lambs, when ready for market, are shipped to packing houses. Goats are profitable in the northern part of the state, where they are put on the "cut-over" lands after the removal of the timber.

Poultry and *eggs* are produced in many parts of the state for local and export markets.



Fig. 76.

A Flock of Wethers.

Dairying is one of the largest industries of the state. The principal products of this industry are milk, cream, butter and cheese. Creameries and cheese factories are found in all of the important cities of Wisconsin. The industry is not confined to the cities, however. In many parts of the state, cheese factories and creameries are

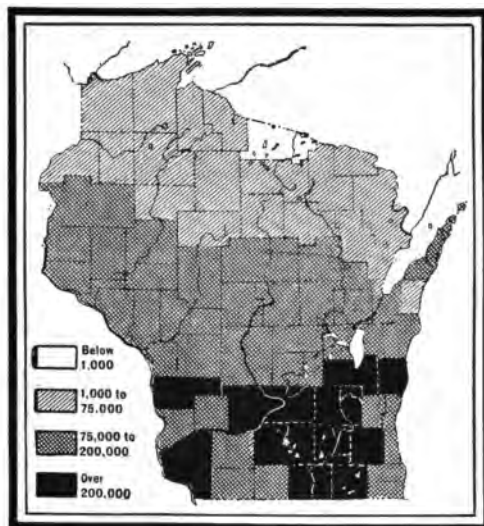


Fig. 77.
Pounds of Poultry Produced per County.



Fig. 78.
Feeding the Chickens. White Wyandottes.

located in the country villages and often at farm houses in order to be more convenient to the farms where the milk is produced.

The cheese of Wisconsin is of a very high quality and is considered fully equal to the famous New York cheese. This result is due partly to the favorable climate, fine

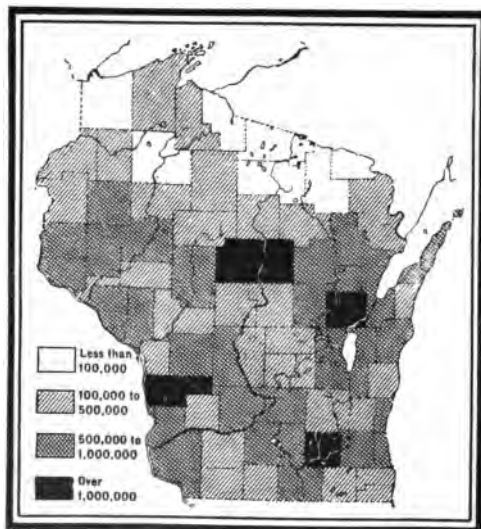


Fig. 79.

Pounds of Butter Produced per County.

grass and pure water of the state, but mostly to the intelligence and vigor with which the industry is carried on. Rapid as has been the development of this industry in the past, it is still growing and is destined to be a most important industry in the state. The principal cheese markets are Milwaukee and Sheboygan, but many other cities, especially those on the shore of Lake Michigan, are important markets for butter and cheese.

The daily furnishing of the cities with milk is a large

industry. Millions of gallons are furnished annually to the cities in Wisconsin and to Chicago. Factories for making condensed milk are located at Racine, Monroe, and Watertown.

Fishing is an important industry in several cities on the Great Lakes. The principal fishes taken from the lakes

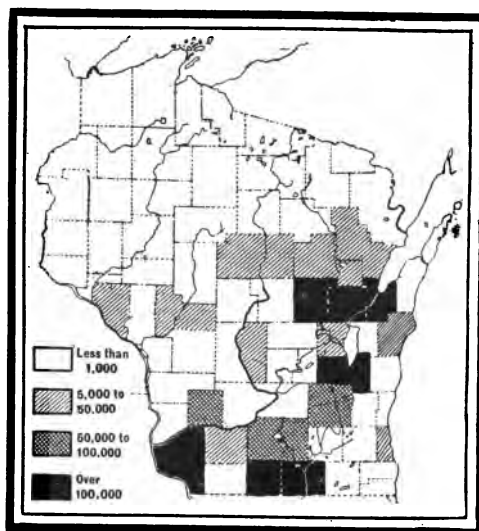


Fig. 80.

Pounds of Cheese Produced per County.

are white fish, lake trout, and herring. The principal fishing markets are Sheboygan, Green Bay, Bayfield (E 2), and Milwaukee.

Pearl Fishing is carried on in the Mississippi river near La Crosse and Prairie du Chien. Pearls are procured from the shells of the common fresh water clam, which is very abundant in the Mississippi river and its tributaries. Pearls worth many hundreds of dollars are not

uncommon. The shells of the clams are used for the manufacture of pearl buttons.

Boat Building is carried on extensively in several of the coast cities. The largest lake boats, over six hundred feet long, are built at Superior, and smaller ones are built at Sheboygan, Milwaukee, Racine and Oshkosh.



Fig. 81.

Fishing for Clams From Which Pearls are Obtained. Mississippi River.

Boots and Shoes are manufactured on a large scale in many cities in the state, and owing to the water power and the nearness to tanneries and leather centers a large increase in this industry is expected. A few of the important boot and shoe plants are located at Milwaukee, Racine, Janesville, Beloit, Chippewa Falls and Sheboygan. The total yearly output for this industry in the state is about eight millions of dollars.

Other Manufacturing Industries. In addition to the manufactures connected with the raw material produced in the state there are other industries of great commercial value.

Agricultural Implements have been manufactured for many years in Racine, Milwaukee and La Crosse. Threshing machines, plows, including the steam plows used



Fig. 82.

Making Shoes at Milwaukee.

in the west, are made at Racine. Plows, drills, harrows and seeders are made at La Crosse and harvesters at Milwaukee. Other factories that make many kinds of farming machinery are located at Milwaukee, Sheboygan, Madison, Janesville and Beloit, and there are also smaller centers where agricultural implements are manufactured and sold.

Machinery of all kinds is made in Wisconsin. Every village where manufacturing is done has its machine shop and many of these shops, starting in a small way, have grown into mammoth establishments with an enormous output. The great Corliss Engine Works and the Rambler Automobile Factory at Racine, the Fairbanks Machine Works at Beloit, the Allis-Chalmers Company at Mil-



Fig. 83.

Interior Cotton Mill. Beaver Dam.

waukee are illustrations of machinery builders with a world-wide reputation, while many smaller plants are located in these same cities and also in Oshkosh, Madison, Eau Claire and Superior.

Many important industries, such as the manufacture of clothing, buttons, cotton, linen, brooms, confectionery and other articles too numerous to mention, are located in favorable places and are important factors in the prosperity of the state.

CHAPTER XIII.

TRANSPORTATION.

When the Indians were the sole occupants of Wisconsin the only transportation routes were the streams for canoes and trails through the woods for traveling overland. With the coming of the white man these conditions have slowly given way to the improved methods of land and water transportation in use today.

Land Transportation. In the thinly settled portions of the state, especially in the northeastern part, the methods of transportation are similar to those used in the early history of the state. Passengers are carried to places out from the railroad in the *stage coach*, which makes regular trips from place to place, usually carrying also express packages and mail. On long journeys the horses are changed every six or eight hours in order to make greater speed.

Freight is carried in such regions by means of wagons drawn by teams of from two to six horses, and in some cases many such wagons are found in groups or "trains." In former times dog teams were frequently used for winter service in the northern part of the state and such teams are occasionally seen now in the northern counties.

The *roads* for this passenger and freight traffic are better than the ordinary roads and are usually built by the counties in which they are located. In early times roads known as state roads and military roads were constructed for long hauling, such as those from Milwaukee to Prairie

du Chien, and from Bayfield through Superior to St. Paul. These roads not only facilitated travel between points along the line but encouraged the settlement of farmers along their routes. (See Chapter XI.) In the lumbering sections of the state, roads are made especially for hauling the logs from the woods to a stream or railroad track for transportation to a saw mill. After the snow is packed down

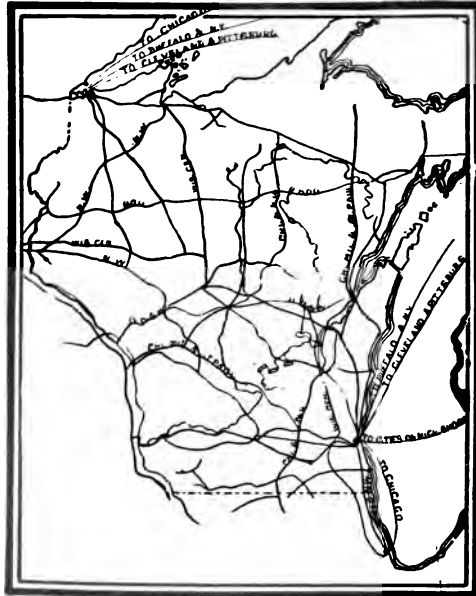


Fig. 84.

Mrs. M. V. Arnold.

Transportation Map of Wisconsin. Shows Principal Railroad and Steamship Lines of the State.

firmly in these roads water is sprinkled over them, making a coating of solid ice, over which very large loads are hauled with ease. (See Fig. 52.)

Canals and Rivers. The first canal to be opened in the state was the one between the Fox and Wisconsin

ivers. It was begun in 1837. The Upper Fox and the Wisconsin rivers were improved at the same time, but the Wisconsin was so difficult to keep open that it was abandoned in 1887. Since that time the Fox river has been improved, but it is not used very much above New London (H 8) and Berlin.

The Sturgeon Bay and Lake Michigan canal connects Green bay with Lake Michigan, greatly shortening the dis-



Fig. 85.

Stock Yards, Milwaukee. Cattle, Hogs and Sheep are Taken From the Cars to These Pens to be Selected by the Buyers for the Packing Houses.

tance from the Fox river cities to Milwaukee and Chicago. This canal was first built by a private corporation, but is now controlled by the United States government, by which it has been fitted for use by the largest lake steamers. About a million tons of freight are carried through the canal every year.

The Mississippi river has long been used as a means of

transportation between St. Paul and the lower river ports, and in this way has been of great advantage to the cities of western Wisconsin. River navigation has not been improved as much in recent years as other methods of transportation, but it may be destined to do greater service in the future. Other rivers in the state, except the Fox and the Rock, have been used only for the transportation of logs or lumber, but several of the tributaries of the Mississippi could be improved for the use of boats.

Railroads. The extensive building of railroads in our state began not more than a half century ago. When Wisconsin was admitted to statehood it contained no railroads, though building was begun on a road running from Milwaukee westward in the following year, 1849. During the years immediately preceding the Civil war, railroad building was not active, but after the war, with the growth of Chicago and the development of the Northwest, railroad construction was pushed so that by 1873 two trunk lines, the Chicago & North Western and the Chicago, Milwaukee & St. Paul, were completed through the state; the Wisconsin Central became a through line to St. Paul from Chicago in 1886.

The effect of topography in railroad building is very marked. The trunk lines running through the state start at Chicago or at Milwaukee and have their termini at St. Paul or at Superior. The surface of the state, though rough in places, is generally level, so that trunk lines may be built across the state at reasonable cost. All railroads follow river valleys where possible, as this not only gives the advantage of the grades of the rivers but brings them in contact with the best productive areas of the region. (See large map.)

The *work* of railroads is the transportation of passengers from one place to another, the carrying of mail and express, and the distribution of freight from the producer to

the consumer. The capacity of a passenger car is from 40 to 100 people, and a train consists of from six to sixteen coaches, depending on the curves and grades over which the trains must pass. The capacity of a freight car is from sixty to one hundred thousand pounds and a train



Fig. 86.

Great Northern Elevator, Superior. Capacity, 5,340,000 Bushels, but it Handles Much More in a Season.

consists of twenty to sixty cars, depending on the curves and grades and the weight of the engine. Railroad builders are straightening the curves and lessening the grades as much as possible, so that larger loads can be carried.

Railroad terminals consist of surplus tracks at points

where freight is loaded and unloaded. Empty cars stand on these tracks waiting to be loaded, and cars that have been brought in loaded are kept on the terminal tracks until they can be unloaded. Terminal yards sometimes consist of many miles of tracks and are very necessary for the rapid handling of freight.

When several railroads enter a city it is necessary to have a *belt line*, an independent railroad, connecting all of the roads radiating from that city, so that freight may be transferred from one line to another. In this way a car loaded at Madison or Milwaukee may be sent over many roads to San Francisco or New York without disturbing the material in the car.

Railroads are a great help in the development of a country. They not only carry people conveniently and quickly but they carry produce to market, and the distance to market determines the freight charges, and, therefore, determines the price. Railroads bring quick mail service and in this way contribute to the education and general intelligence of the masses of people.

The proper adjusting of freight charges, or tariffs, as they are called, is a complicated matter, requiring the most expert knowledge of general and local conditions, distances, competition, etc. Frequently the roads are accused of discrimination—that is, giving one city a better rate than is given to another city under similar circumstances. This enables the business men in the favored city to undersell the others and so obtain more than their just share of the trade.

Thus, by discrimination in freight rates, railroads can develop or destroy the prosperity of cities. Repeated cases of this and other abuses of equal injustice led Congress to establish the Interstate Commerce Commission for the purpose of regulating traffic on roads having lines connecting two or more states. The state of Wisconsin also

has a Railroad Commission that regulates railroad rates and service within our own state.

Electric Cars. Street cars propelled by electricity are used in all of the cities of any size in the state. All of the larger cities have interurban car service, which affords easy and rapid transportation between the city and its suburbs and often extends to other cities. There are such lines connecting Milwaukee with many of the surrounding cities, especially those on the lake shore. An electric



Fig. 87.

Steel Freight Boat Unloading Coal at Docks at Superior. This Steamer is 540 Feet Long, 56 Feet Wide at Deck and will Carry 10,000 Tons of Coal or Ore.

line of great importance connects Fond du Lac with Oshkosh and with other cities of the Lower Fox river.

The Great Lakes. No state occupies a more favorable relation to the Great Lakes than our own. The ports of Lake Michigan are near the productive areas of the central and southern parts of the state and are connected by rail with the states of the central Mississippi basin, while the ports of Lake Superior are used by the states westward to the Pacific coast.

Fifty years ago the boats on the lakes were mostly small,

wooden sailboats. They carried lumber, furs and minerals from Wisconsin eastward, and manufactured goods, supplies of food and clothing and working utensils westward. The harbors were soon improved by the government and



Fig. 88.

Boats Loading Ore at Dock. Terminal Facilities for Lake Traffic. Ore Docks Located at Superior and Ashland. Largest Boats Loaded in From One to Two Hours.

steel boats became more common. The improvement in transportation on the Great Lakes has been rapid. A modern freight steamer carries 6,000 to 10,000 tons of merchandise, usually going down the lakes with grain, minerals, lumber, or a mixed cargo and bringing westward coal, steel,

or a cargo of supplies of all kinds for western points and often for the Orient. The lake traffic to and from Wisconsin points is tremendous, reaching in 1910 the high mark of about 25,000,000 tons.

Closely allied to the business of transportation is that



Fig. 89.

Scene on the Brule River, Douglas County. One of the Most Famous Trout Streams of America.

of *entertainment*. This includes the ordinary hotels and restaurants and the *summer resorts*. Every village in the state has one or more hotels and in the larger cities there are many, some of them imposing in appearance and elegantly furnished.

Throughout the region known as The Dells of the Wisconsin, along the shores of the Great Lakes, as well as many of the small lakes in the state, and in the Great

North Woods, are hundreds of hotels and cottages which, in summer, are filled with people who have left the heat of the city for a little rest. Most of these are entirely deserted in winter, but the care of the summer guests gives employment to thousands of people and is an industry which is growing in importance.

CHAPTER XIV.

PRINCIPAL INDUSTRIAL CENTERS.

It is interesting to find how cities originate and why they grow. One village may spring up and develop into a flourishing city, while another with apparently the same start may remain a village or an unimportant city. The reasons for this irregularity of growth are generally traceable to some advantage connected with its geographical location or with transportation.

Location of Cities. Many important trade centers of Wisconsin were originally Indian villages, used afterwards by the white man as fur trading posts. Others, in the rich agricultural districts, grew up at the crossing of railroads, and a number of large industrial centers of the state were first saw mill sites or lumber camps. Good harbor facilities determined the location of cities on the Great Lakes, while on hundreds of the small lakes of the state, summer resort villages have grown up because of the beautiful and health-giving surroundings.

Why Cities Grow. Cities grow because they meet important demands of business or of pleasure. Manufacturing centers are developed at places having water power, cheap fuel, or unusually good facilities for transportation. Some cities, as Milwaukee, having most or all of these advantages, become great manufacturing centers. Distributing centers develop where transportation facilities for collecting and sending out commercial products are good. Superior is a good example of a distributing center. As distributing centers grow older they often become manufac-



Fig. 90.

Public Library at Milwaukee.

turing centers, such as Racine and Kenosha on Lake Michigan.

Energy and public spirit are also powerful factors in the building up of a city and are sometimes able to overcome the lack of natural advantages.

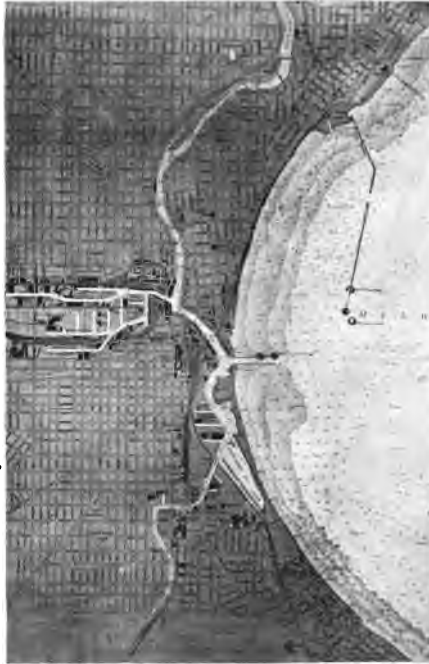


Fig. 91.

Map of Milwaukee Harbor. Shows Location of Manufacturing Plants Along the Rivers, Which Have Been Dredged to Admit Large Lake Boats.

Distributing Centers. A distributing center is a place where special facilities are afforded for placing goods before people who buy and use them. The manufacturer, the one who makes the goods from raw materials, does not sell to the consumer. The manufacturer sells to the whole-

sale merchant, who buys from many manufacturers and keeps a large stock in warehouse. The wholesale merchant sells to the jobber, a man who buys in smaller quantities from many different wholesalers, or sometimes from only one, and who keeps his goods in warehouses and sends out

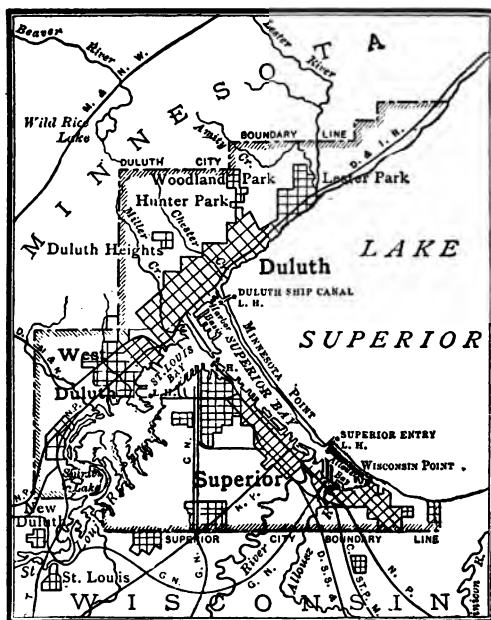


Fig. 92.

Superior Harbor. One of the Most Extensive Inland Harbors in the World.

salesmen or commercial travelers, as they are called, to sell goods to retail merchants. The retail merchant sells to the people who use the goods. The wholesaler and the jobber are usually called the "middlemen," because they stand between the manufacturer and the consumer. Retail stores are of two kinds, special stores and department stores. Special stores handle only one line of goods, such as dry

goods, hardware or clothing; while the department store handles several kinds of goods, such as dry goods, clothing, shoes, drugs, and sometimes many others, all in one store. Many cities have stores of two or more departments, but Milwaukee has some very complete department stores in which almost everything needed in a home can be bought.

Cities on Lake Shores. The cities on Lakes Michigan and Superior are situated near good harbors formed generally at the mouths of rivers. An important reason for



Fig. 93.

View in Milwaukee Harbor.

their location was the connection by water with eastern cities from which the early settlers came. The building of railroads and the development of the Mississippi basin have caused them to grow.

Milwaukee (373,857). The great cosmopolitan city of Wisconsin is Milwaukee. It is located on a harbor at the mouth of the Milwaukee river. Passenger and freight boats and car ferries give daily service to points on the

east and west shores of Lake Michigan. Boat service is also very complete to Chicago, where connection is made with the railroad lines of that great city. Passenger and freight boats ply constantly, except a short time in the winter, between Milwaukee and points on Lakes Huron, Erie and Ontario and through the St. Lawrence river out into the Atlantic ocean. In addition to these transportation lines there is an extended network of railroads west-



Fig. 94.

From King's Geography.

Making Stoves at Milwaukee.

ward, which penetrates the areas productive of grain, live stock, tobacco, lumber and minerals, reaching far west of the Mississippi river. Milwaukee is an important center for the manufacture of lumber and lumber products, iron, leather, boots and shoes, knitted goods, clothing, malt and malt liquors, flour and packed meats. Besides these, there are hundreds of smaller industries of importance which have grown out of the demands of the country tributary to the city.

Milwaukee has water power within the city limits, but it also receives electricity for power and for lighting from Kilbourn City (G 13), on the Wisconsin river, many miles away. It has excellent street car service and has many public buildings of great architectural beauty, such as the State Normal School and the Public Library and Museum.

Racine (38,002) is the largest Wisconsin city on Lake Michigan south of Milwaukee. It is favorably situated



Fig. 95.

Pattern Room in Wagon Factory. Racine.

for lake traffic, has a well kept harbor and excellent railroad connection westward. Although a good distributing center, its success is due largely to its manufacturing interests. It leads all of the cities of the state in the manufacture of agricultural implements, such as plows, threshers, wagons and harvesting machinery. The famous Corliss engines are made in a suburb of this city. Factories for malted milk, automobiles, boots and shoes, knitted goods and many others of lesser importance are also located here. The total value of manufactured products in 1905

was \$17,000,000, a remarkable showing for a city of 38,000 people.

Kenosha (21,371) is a port on Lake Michigan, south of Racine, with similar facilities for transportation by lake and rail. It has a great variety of manufactures, such as automobiles, leather, iron and knitted goods, which are shipped to the trade in all directions.



Fig. 96.

Making Knitted Goods. Kenosha.

Sheboygan (26,398) is the most important city and harbor on Lake Michigan north of Milwaukee. It is surrounded by a rich agricultural and dairy region and is the largest market for cheese in the state. The manufacturing interests here are large, the manufactured products

being veneer, refrigerators and furniture, especially chairs. Its commerce, compared with its population, is very large.

Sheboygan Falls, a suburb of Sheboygan, manufactures wool, leather, furniture and agricultural implements.

Manitowoc (13,027) is a thriving city on one of the best harbors on Lake Michigan. It has good railroad connections and a feature of its lake trade is a car ferry of the Pere Marquette railroad to points on the eastern shore of Lake Michigan. Its chief manufactured products are furniture, agricultural implements and canned vegetables.



Fig. 97.

Assembling Room, Automobile Factory, at Kenosha.

Marinette (14,610) is an important lumber center on Green bay.

Superior (40,384) is situated at the head of navigation on Lake Superior. It has the largest and one of the best developed harbors on the Great Lakes, with about fifty miles of harbor frontage, much of which has been used in

the construction of docks. Grain, wool, iron ore and other products from the west and northwest, and also from Canada, are brought in by the railroads and shipped by boat to eastern markets; while the cargoes from the returning boats, consisting of manufactured goods and coal, are transferred to cars and distributed westward as far as the Pacific coast.

Immense grain elevators and coal docks are located in Superior, the largest, perhaps, in the world. The combined storage capacity of the elevators is over 18,000,000 bushels and of the coal docks is considerably over 3,000,000 tons. The lake commerce in 1909 was 15,722,709 tons.



Fig. 98.

Cabinet Work Factory. Manitowoc.

In addition to the commerce of distribution, in which Superior exceeds all other cities in the state, there is considerable manufacturing in the city. Large lake steamers, windmills, furniture, mattresses and iron pipes are made



Fig. 99.

Launching a Large Steel Freight Boat. Superior.

here and shipped over a large area west and southwest. A state normal school is located here.

Ashland (11,594) is situated at the head of Chequamegon bay, has good transportation advantages by both water and rail and is well located for manufacturing and distribution. Grain, lumber and iron ore are shipped eastward by the lake route and the boats return with manufactured goods and coal to be shipped west and south. The chief manufacturing plants are saw mills and an iron smelter. In connection with the smelter there are charcoal ovens, in which charcoal and chemicals are made from wood.

The Apostle islands, in the lake nearby, contain summer resorts of considerable note.

Cities of the Fox River Basin. These cities have access to the water power and transportation advantages of the Fox river and its tributaries. The region also has great resources in agriculture and lumber.

Oshkosh (33,062) is located on the west shore of Lake Winnebago, a fine location for transportation by water and rail. Its connection with the forests of the Upper Fox has led to the extensive manufacturing of lumber products, such as furniture, veneer goods, especially of birch, sash and doors, trunks, shingles and matches. Machinery, agricultural implements, gas engines, yachts and automobiles are manufactured and supplied westward to a large wholesale trade. The city is also a large wholesale center for many staple products on account of the fact that its transportation advantages make it a good distributing point. It has many public institutions and is the seat of one of the largest of the state normal schools.

Fond du Lac (18,797) is located at the southern end of Lake Winnebago. It is surrounded by a fine agricultural region and has the advantages of transportation by the Fox river and several railroad systems. Like the other

cities on the Fox river, it manufactures lumber products, such as lumber, boxes, sash and doors and refrigerators. It also has a very large tannery and manufactures boots and shoes. The city is noted for dairy products and the canning of vegetables, especially peas.

Menasha (6,081), *Neenah* (5,734), *Appleton*, *Kaukaunna* and *Green Bay* are located on the Lower Fox river and owe much of their thrift and progress to the water



Fig. 100.

Automobile Factory at Racine.

power of that river. The manufacture of paper from wood is the principal industry of these cities and their combined output is many tons daily.

Appleton (16,773) has the largest water power on the river and in addition to making paper has factories of furniture, knitted goods and felt. *Green Bay* has furniture and match factories and is the seat of a large vegetable canning industry.

Cities of the Granite Area. This region, located in the northern part, contains the oldest rocks in the state.

It has valuable resources, consisting of forests, granite, water power and a good, productive soil, though its development is still in its infancy.

Wausau (16,560) is the principal city in this area and is the largest city in the Wisconsin river valley. It is surrounded by a successful farming community that has been developed on the "cut-over" forest land. The leading industries are lumbering and the manufacture of lumber products, as sash and doors, boxes and veneer. Tanning is also an important industry and sandpaper is made from the powder of corundum, a very hard mineral found near the city. Granite quarries are nearby, from which the famous Wausau granite is obtained. There are great possibilities of water power near Wausau, some of which have been improved.

Rhineland (H 6) (5,637), and *Merrill* (8,689) are two important cities in this district above Wausau. They have good water power in the Wisconsin river and have large mills for the manufacture of lumber, lumber products and paper. The tanning of leather is an important industry also.

Cities of the Sandstone Area. The forest once covered this land and the cities were all started by lumbermen. Some of the forest still remains, but, while the lumber industry is still carried on, farming and manufacturing are the principal sources of prosperity. In addition to general farming, which is very successful in this district, the raising of potatoes, sugar beets, tobacco, and fruits are important industries.

Eau Claire (18,310) is situated on the Chippewa river, near a water-power site that was first used by a saw mill. It is a progressive city and its principal manufactured products are lumber, paper, furniture, leather, boots and shoes and carriages. It has also a meat packing house, a canning factory, and for a number of years has had the only

linen mill in the state. Its transportation advantages are afforded by two railroads and by a trolley line to Chippewa Falls.

Chippewa Falls (8,893) is a thriving industrial center of this district. It is located near the largest water power on the Chippewa river and is surrounded by excellent farms. It has a number of manufacturing plants such as lumber and planing mills, woolen and flour mills, boot



Fig. 101.

Making Rubber Goods. La Crosse.

and shoe factories, sugar factory and a factory for the canning of vegetables. Fruit raising and dairying are important industries in the surrounding country.

La Crosse (30,417) is in the southwestern part of this area, on the Mississippi river. It was among the first lumber centers in the state and is yet engaged in the manufacture of lumber products. With the development of the surrounding agricultural area, La Crosse became a center for the manufacture of agricultural implements,

wagons, carriages, stoves and other household articles. (See Fig. 101.) Other manufactured products are flour, knitted goods, rubber goods and malt liquors. The Mississippi river and the railroad connections furnish transportation facilities that have led numerous wholesale houses to locate in this city.

A state normal school is located here.

Stevens Point (8,692), in Portage County, is situated on the Wisconsin river. Near the city, the river furnishes an important water power which is used in the manufacture of paper. Other manufactures are lumber and lumber products and artificial flies to be used in trout fishing. A state normal school is located in this city.

Sparta (E 12), the county seat of Monroe County, is situated in the southern part of the Sandstone area, on the La Crosse river. It is surrounded by a very rich agricultural region, which is especially adapted to the raising of berries and tobacco. Its manufactures are lumber and dairy products and cigars. Strawberries and vegetables are shipped from this point.

Cities of the Limestone Area. This region includes a number of counties in the southern and eastern parts of the state which rank high among the richest farming and dairy sections of the United States. Many villages, starting as markets, have become important distributing and manufacturing centers.

Madison (25,531) is the capital of the state and the county seat of Dane County. It is situated on a hill of glacial deposits between Lakes Mendota and Monona and commands a fine view of the surrounding country. The State Capitol, when completed, will be one of the most beautiful and commodious of its kind in the country. The State University, located here, ranks among the foremost universities in the United States.

Dane County is noted for the quality and quantity of

tobacco produced, and Madison is an important point for its storage and manufacture. The city also contains factories for making agricultural implements, farmers' supplies, boots and shoes, beet sugar and brass goods. It is a good wholesale point, especially for agricultural implements and tobacco.

Janesville (13,894), the county seat of Rock County, is situated on the Rock river. The river furnishes water power which is used for manufacturing. In the city are large tobacco warehouses and a beet sugar factory, which are supported by the raw material produced in the surrounding country. There are also flour mills and factories for making paper, boots and shoes, furniture, agricultural implements and fountain pens.

Beloit (15,125) is located in the southern part of Rock County, near the border line of the state. Like Janesville, it is in a rich agricultural district and is especially noted for factories and wholesale houses which supply the needs of the surrounding districts. It is a good railroad center and has factories for the manufacture of agricultural implements, pumps, gas engines, scales and machinery.

Beloit College, a private institution of high rank, is located here.

Prairie du Chien, one of the oldest cities in the state, is situated on the Mississippi, south of the mouth of the Wisconsin river. It is well located for water transportation and was formerly the headquarters for the lead mines farther east and south. It has manufactories of farming implements and is a center for the pearl fishing industry on the Mississippi river and its tributaries. This city is a well-known summer resort and has mineral waters, including a famous artesian well.

Portage (H 13) (5,440) is an interesting city located on the narrow passageway between the Fox and the Wisconsin

rivers. In earlier times, when the canal between the Fox and Wisconsin was supposed to be an important waterway, Portage was more important than it now is. The surrounding country is a dairy and farming region and the city of Portage is a market and distributing point for this region.

Watertown (8,829) is located in a splendid agricultural district and is a supply center for all implements and necessities of farmers. The surrounding region is noted for poultry, especially ducks and geese, and the dairying interests are considerable. It has factories for the manufacture of furniture, malt, shoes, paper boxes and other articles. A factory for condensed milk is located here.

Watertown is the seat of Northwestern University, a private college of high standing.

Cities of the Mining Areas. The mining areas, as has been said, are in the northern and southern parts of the state. No large cities have been developed from this industry and many of the cities in mining regions owe their prosperity to agriculture as much as to mining.

Hurley is an iron mining center in the northern part of the state. Mining is carried on extensively in this region and several suburban villages have sprung up at the different mines. The ore is shipped down the lakes through the docks at Ashland.

Platteville (F 15) is an important mining center in the southwestern part of the state. It has recently made rapid growth on account of the revival of zinc mining. In the city are shops for making and repairing mining machinery and it is a center for the manufacture and distribution of farmers' supplies.

Platteville is the seat of a state normal school and of the State School of Mines.

Mineral Point (F 15) is a thriving city in Iowa County, in the zinc and lead district. Its most important enter-

prises are a zinc smelter and a factory for the manufacture of zinc oxide and sulphuric acid. The city is also an important market and distributing center for agricultural products and farmers' supplies.

Baraboo (G 13) (6,324) is an interesting city located near the Baraboo Ridge. It is noted for the production of iron ore, which is shipped to Chicago and Milwaukee. Baraboo is a supply depot for a rich agricultural region, and has a number of important factories. Devil's Lake, near by, is a pleasure resort, famous for its beautiful scenery.

Mayville, in Dodge County, has a large iron mine. The ore is obtained in the Clinton limestone and is shipped to a smelter in Milwaukee.

CHAPTER XV.

IMPORTANT EVENTS IN WISCONSIN HISTORY.

The Indians. When America was discovered Wisconsin was inhabited by the Indians. Although the boundaries of the tribes were not very well defined, the northern part was inhabited mostly by the Chippewas and the southern part by the Winnebagoes, both peaceful tribes. Other tribes were found in various parts of the state, and occasionally there occurred an invasion of the warlike Sioux from the land farther west.

These people and their forerunners had built curious mounds in many parts of the state. These mounds have been thoroughly studied and found to contain many indications of life and customs of the early inhabitants of Wisconsin.

The First White Men. While the red men were pursuing the daily routine of hunting, fighting and religious ceremony, there came into their midst a white man whose presence awakened surprise and fear, although they may have heard of him before. This man was Jean Nicolet (Nic'-o-lā), who came upon the village of the Winnebagoes at Red Banks, near the mouth of the Fox river, in 1634. Nicolet was a French frontiersman from Canada, and after making a treaty of peace with the Indians at Red Banks, he ascended the Fox river to a point near Berlin, where he found other friendly tribes.

The First Fur Traders. Following the visit of Nicolet came the fur traders, who mixed closely with the Indian tribes. The most important of these were Radisson and

Grosseillers, the daring French explorers, who probably crossed the divide between the Fox and Wisconsin rivers and descended the latter into the great Mississippi.

The First Missionaries. The ever zealous missionaries followed the fur traders and established missions in various parts of the state. The first of these was established by Allouez (Al-lou-ā') at La Pointe (E 3), on Chequamegon (Che-quām'-e-gon) Bay, near Washburn (E 3),



Fig. 102.

Old State Capitol, Belmont.

and later another at DePere, near Green Bay. The northern part of the state soon became pretty well known to the white men through the missionaries and fur traders.

The First Great Waterway. Since the French had possession of Louisiana at the mouth of the Mississippi river and New France at the mouth of the St. Lawrence river, it is not strange that they should wish to open easy communication between the two colonies. This was accomplished by using the waterway known as the Fox-Wisconsin,

a continuous water route from Lake Huron to the Mississippi, with the exception of a short marshy strip of land, one and one-half miles long, between the Fox river and the Wisconsin, over which the boats could be carried or portaged. The Indians must have known of this route from remote times, but it was first used, under authority of the French government, by Father Marquette, a missionary, and Joliet (Zho'lyā), an explorer, in 1673.

This route remained famous for many years and was much used by the French and early English occupants. The Americans also looked upon it as an important possession, and after a most vigorous agitation a canal was cut between the Fox and Wisconsin rivers at Portage. Both rivers were provided with canals and locks where necessary, so that boats of considerable size could pass from Lake Michigan to the Mississippi river and the Gulf of Mexico.

The French Domination. The French eagerly took possession of this fertile land and made haste to occupy it with settlements. The fur traders were successful, not only in their business ventures but also in winning the allegiance of the tribes to the French government. Great explorers such as Perrot (Pa rō'), La Salle, Duluht and La Seuer (Leh Sü'ur) traveled back and forth in the state and opened up new routes and regions, all of which they dedicated to the French government. The settlements did not thrive and since the colonists from New England were pushing vigorously westward, the capture of the territory by the English was an easy task. However, the zeal of the early explorers for France was not lost. It had made such a powerful impression upon the natives that it remained a strong influence even after the occupation and settlement by the Americans.

The Coming of the English. With the fall of New France in 1760, the territory of Wisconsin passed into the

hands of the English. It was so thoroughly French, however, that the feeble attempt to make it English had but little effect. About the only industry was fur trading, which attracted people from many lands. During the Revolutionary War, but little if any assistance was given the cause of freedom by the Wisconsin territory, unless, perhaps, some lead was obtained from the mines of the southwestern part.

The Occupation by Americans. The Treaty of Paris, which terminated the Revolutionary War, placed the territory including Wisconsin under the control of the United States, but the English retained actual control over the lake ports until 1803, and did not entirely abandon the territory until after the war of 1812. The American occupation now became complete and the development of Wisconsin began.

The Territory of Wisconsin. The progress of Wisconsin has been rapid. In 1800 it was a part of Indiana Territory, but in nine years Indiana was made into a separate territory and the remainder of the former territory was called Illinois. In 1818 Illinois was given statehood and Wisconsin was attached to Michigan and given for the first time a definite form of government. The Indians were induced to cede all of their lands to the general government for certain small considerations, reserving only such tracts of land as were required for meager subsistence.

Wisconsin was detached from Michigan in 1836 and given a territorial government, with Madison as the capital. The boundaries at this time included much of the northeastern part of Minnesota, and at one time the northern peninsula of Michigan. During the territorial period the growth in population was rapid. Immigrants from New England came over the lakes to Milwaukee, Racine or Kenosha, while the lead districts of the southwestern part

were filled with people who came overland from regions farther south. Pioneer life was hard but fascinating, and the rich rewards of his labor made the farmer independent. When the agitation for statehood came, the sturdy independence of the people was shown in a severe struggle with Congress over the adjustment of the boundary lines of the state.

Wisconsin Becomes a State. In the year 1848 Wisconsin was admitted as a state with a population of over 200,000 people. The inhabitants were nearly all in the region extending from Green Bay southward to Milwaukee and Racine and westward to Prairie du Chien. The belt along Lake Superior also had a few villages and trading posts, but the central and northern parts were an unbroken wild.

Rapid Growth of the State. The people from many states and foreign countries flocked to the new state. The bracing climate, the unexcelled natural advantages in soil, timber and minerals were attractive to the American and foreigner alike.

The German element has always predominated in the state and it has been estimated that over one-half of the population is of German descent. Groups of people are found in many parts of the state that were started as small colonies from certain communities in Europe and have grown into populous districts by immigration from the same communities. In this way colonies of Danes, Scandinavians, Russians, Poles, Welsh, Belgians and Dutch, as well as Germans, are found in different parts of the state. From 1848 to 1860 the increase in population was nearly 300 per cent. The population in 1910 was 2,333,860.

CHAPTER XVI:

STATE EDUCATION.

The education of greatest importance to the state is that of the common school, for it reaches every boy and girl between the ages of four and twenty. The common or public schools are organized under the state laws, and consist of the kindergarten, the grades from the first to the eighth, and the high school, all of which are provided free of charge to the boys and girls of Wisconsin.

The Plan of the Schools. The kindergarten includes two years of work in which children are taught self-activity by games and hand work. The rural or ungraded schools are those in the country districts in which all grades are taught by one teacher. The grades consist of eight years of work, so planned as to include the rudiments of knowledge and so arranged that the growing mind readily understands what is taught. The high school is an institution of higher grade, in which the more advanced subjects are taken up. Students are here prepared for higher educational work in the university or for active life. Regular courses of study are made out for each of these schools. The course for the rural schools is published under the authority of the State Superintendent. The courses of study for the grades and the high school are made out by the principal or superintendent of the local school system, under restrictions imposed by law.

Encouragement Given by the State. Special financial aid is given to schools that qualify under certain provisions of the law. The provisions refer mainly to the

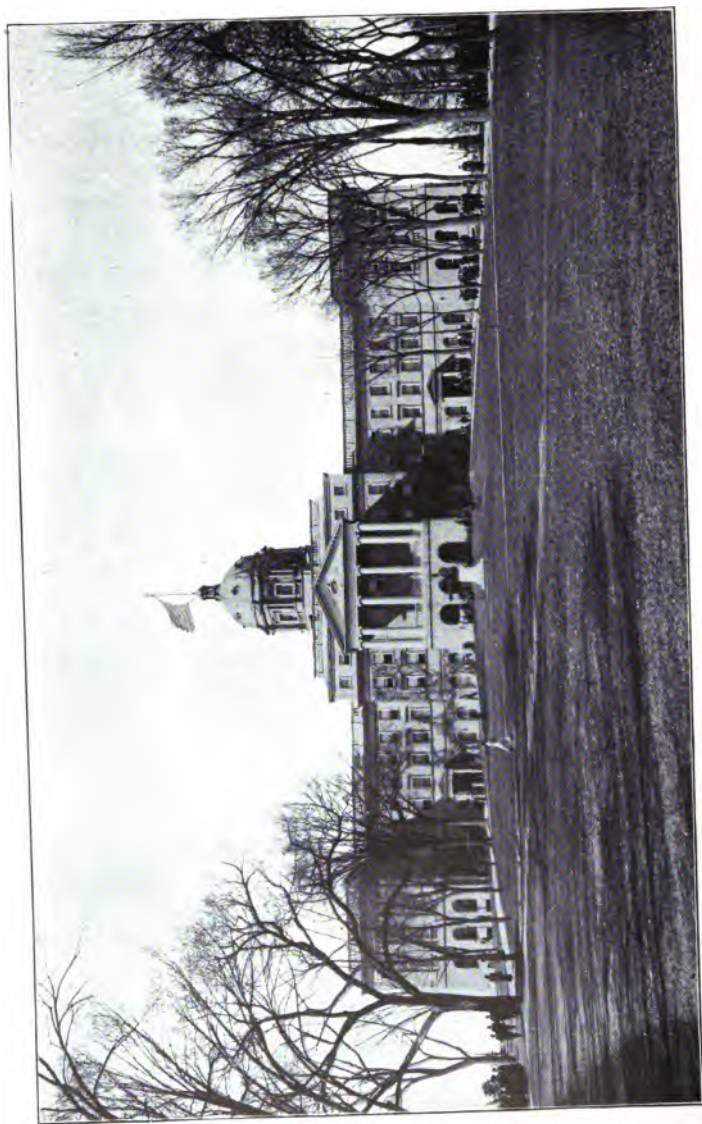


Fig. 103.
Main Hall. State University, Madison.

course of study, which must be made out by the State Superintendent, the equipment of maps, apparatus, libraries, and certain standards of qualifications for the teachers. This aid, ranging from one hundred to five hundred dollars per year, is given to rural and high schools, and has resulted in making these schools much better.

Most of the money to carry on the common schools is raised by local taxation in the districts and cities in which the schools are located, but a certain amount is distributed from the State School Fund to each district, according to the number of pupils of school age.

The Teachers in the Public Schools. No person is allowed to teach in the public schools of the state without a certificate of qualification granted by some person or body authorized by law to conduct an examination for that purpose. The State Superintendent of Public Instruction, or the County Superintendent, can grant certificates on examination, or the State Superintendent can issue certificates based upon the diplomas conferred by the normal or the county training schools.

The Normal School System. The normal schools of Wisconsin, eight in number, are controlled by a Board of Regents, consisting of the State Superintendent and eight people appointed by the Governor of the State. The Teachers' Institutes of the counties are under the control of the same Board. The purpose of the normal school is to prepare people for the profession of teaching. A course of study, including all the common branches and other subjects necessary to the teaching of the common branches, is given, requiring four years for its completion. Graduates of approved high schools may complete the course in two years.

The County Training Schools are institutions supported partly by the state and partly by the counties in which they are located. Their purpose is the preparation

of teachers for the rural schools. There are now twenty-three of these schools in the state, and more will be formed in the near future.

The State University. The State University at Madison is the highest school in the educational system of the state. It is controlled by a Board of Regents, all of whom are appointed by the Governor except the State



Fig. 104.
County Training School, Marinette.

Superintendent. This great institution has recognized its obligation to the whole people and has taken an active part in the development of the natural resources of the state. It is called the "University of the People," because of its efforts to reach all classes with the instruction that each needs. In this way the farm, the dairy, the water-power interests, the machine shop, the factory, and the

mine, as well as the learned professions of medicine, law and teaching, have felt the uplifting influence of this great school.

State Superintendent. The educational system of the state is presided over by the State Superintendent, who is the administrator of the law in all matters pertaining to the public schools. In his office are inspectors of high schools, rural and state graded schools, and schools for the deaf. These inspectors visit the respective schools under their care, and endeavor in every way possible to improve the quality of work done.

Other state institutions in which education is carried on with more or less special objects in view are the School for the Blind at Janesville, School for the Deaf at Delavan, Industrial School for Girls at Milwaukee, Industrial School for Boys at Waukesha and the State Reformatory at Green Bay.

Other Institutions of Learning. Besides the State institutions there are a number of private schools of high rank which give instruction in many lines equal to that of the University. Such schools are Beloit College at Beloit, Lawrence College at Appleton, Ripon College at Ripon, Carroll College at Waukesha, Northwestern University at Watertown, Marquette University at Milwaukee, Milton College at Milton and Milwaukee-Downer College at Milwaukee.

CHAPTER XVII.

CO-OPERATION OF THE STATE AND THE CITIZEN.

While the state is composed of citizens, and its government is supported by taxation, the benefits return in many ways to enrich the individual. Besides the general benefits of government and protection, the state has undertaken the solution of many problems far-reaching in their influence on the general welfare and prosperity of its citizens.

The State Agricultural College. This institution of learning is one of the colleges forming the State University, but is supported in part by the United States government. Regular courses in many lines of agriculture, horticulture and stock-raising are given by the faculty of the college and elaborate equipment, including libraries, laboratories and a well stocked farm, have been provided. All of the teaching is illustrated as far as is possible by actual conditions on a farm conducted as a model.

Experimenting with Farm Products. For many years the Agricultural College has been engaged in lines of study and experimentation designed to find the best way of carrying on the work of the farm. The results of this work have been given freely to the people in the bulletins and other methods of publicity used by the college, and in the past twenty years many improvements of importance have been introduced on the farms of Wisconsin as a direct result of the work of this college.

Pure Seeds. Recognizing that the seeds of good healthy



Fig. 105.
College of Agriculture, State University, Madison.

plants are of the greatest importance to the farmer, the Agricultural College has for years been selecting and distributing perfect seeds of the varieties of plants best adapted to this soil and climate. This work has greatly improved the yield of farm crops, especially oats, barley, corn and tobacco.

Injurious Insects and Plants. No one thing has so discouraged the farmer and so blighted his prospects as these pests. Different methods of combating such enemies by sprays, solutions, and tilling are tried at the Agricultural College, and the results published over the state. In this way remedies for smut in oats, blight in potatoes, and several kinds of insect pests have been successfully devised, and many thousands of dollars are saved each year to the planters.

Soils. Different soils, according to structure, texture and composition, are adapted to different crops, and it is a matter of great importance to get the crop and the proper kind of soil together. The Agricultural College helps to solve this problem by testing the soils and recommending certain crops where necessary.

Experimental Farms. In addition to the great farm located at the University, the state has established experimental farms in the thinly settled parts of the state for the purpose of determining the crops and methods of cultivation best suited to the region. Trial orchards are often found in connection with the farms.

Tobacco. This important product has been the special object of study at the experimental farm, with the result that the quality and yield in the state have been very much improved.

Cranberries. Cranberries are grown in swamps in the glacial drift in the central and northern parts of the state. An experimental station has been located at Cranmoor (G 10), in one of the swamps, for the purpose of deter-

mining the best methods of culture and harvesting of this important product.

Dairying. In Wisconsin dairying has reached a high degree of perfection. The Agricultural College has been working with the farmers to bring this about, and has been largely the cause of its rapid advancement. Wisconsin cheese ranks above any other cheese in the markets of the United States and in quality of its butter Wisconsin stands



Fig. 106.

Butter Making by Students in Laboratory of Agricultural College, Madison.

almost as high. Many inventions and improvements which render farming more economical and more profitable have been worked out by those in charge of the Agricultural Experiment Station at Madison. Among these inventions, the Babcock Test for butter fat in milk is the most important, and it is so necessary to the modern dairy that it is used in nearly every civilized country.

Farmers' Conventions. The Agricultural College sends out its professors and other trained experts to attend meet-

ings in different parts of the state. At these meetings, questions relating to farming, stock-raising, and the cultivation of fruits and vegetables, are discussed in the light of the latest discoveries and improvements.

The State University. In addition to its academic and research work at Madison, the State University is assisting the citizens of the state in other respects. These aids are principally in the lines of correspondence work,



Fig. 107.

Cheese Making by Students in Laboratory of Agricultural College, Madison.

lectures, libraries for the investigation of certain topics and other kinds of University Extension work. Any individual or group of individuals desiring to study any subject offered in the correspondence courses may enroll for such work and be directed in his study by an instructor of the University. In places where ambitious young people have been compelled to go to work in factories without higher education, an instructor may be sent from the University to form classes in the fundamental principles of the

work that is being done in the shops. This makes their work more effective and insures an earlier promotion. In history, literature and kindred subjects, men are sent to give courses of lectures in addition to the correspondence work. Debating societies are also encouraged and help is given in the investigation of any subject desired.

Natural History Survey. This is an organization by a staff which works in conjunction with the University.



Fig. 108.

Studying Agriculture. Class of Farmers in Agricultural College, Madison.

The survey has investigated the different kinds of rocks, ores, building stones, clays, sand and soils, and has made maps locating them so that industries relating to them may be developed. It has also helped in locating and estimating the water powers of the state and has assisted in constructing good roads in different counties.

The State Historical Society. This institution is controlled and supported by the state. It has an extensive

library which is used for its own work and also by the State Legislature, as well as by the University. Historical facts and records on many subjects, especially those relating to the history of Wisconsin, are compiled, and publications are issued periodically for distribution. The Free Library Commission advises and assists public libraries, conducts a traveling library system, and maintains a much used legislative reference library in Madison.



Fig. 109.

Study Class In Factory, Milwaukee. Correspondence Work of State University.

The State Horticultural Society. This is an organization devoted primarily to the encouragement of fruit culture in Wisconsin. For a long time in the early history of the state, fruit-raising seemed to be unprofitable, and it was consequently neglected. After the organization of the State Horticultural Society, investigations began which resulted in the importation of foreign fruits, especially

from Russia, developed under conditions similar to our own. This has resulted in complete success, and Wisconsin is destined to become a prominent fruit-raising state. The society co-operates with the State Educational Department in beautifying rural school grounds all over the state.

Trial Orchards. In several counties in the state, trial orchards have been established and placed under the direction of the State Horticultural Society. In these orchards different kinds of fruit are planted and treated in different ways so as to determine the kind of fruit and the method of treatment best suited to that particular region.

The State Fair Association. The State Fair is held every year on the State Fair Grounds near Milwaukee. Its object is to encourage the improvement of farm products and animals by furnishing an opportunity to display and compare the different kinds. Awards of money are given to the best exhibits every year, so that farmers and others may be encouraged to produce and exhibit only the best. The association also has exhibits of farm machinery under the same conditions as farm products, and it, therefore, serves as a medium of advertisement for the best and latest in products and machinery of all kinds.

Dairy and Food Commission. The high reputation of Wisconsin in dairy products is to be maintained. The Dairy and Food Commission gathers information concerning the latest and best methods in dairying and disseminates it among the dairymen. The Commissioner is also charged with the duty of enforcing the pure food law. Several assistants to the Commissioner are constantly in the field buying foods and testing them. Companies whose foods are found impure are barred from selling such articles in the state and the merchants selling such foods are dealt with according to law. The list of impure foods is published and distributed in this and other states.

The Rate Commission. This Commission consists of three men appointed by the Governor. It has control in a general way over the public service corporations of the state, such as railroads, express companies, telephone, water, light and gas companies. With a corps of expert engineers, the Commission examines into all complaints of poor service or unjust rates. After going over the books of the company complained of, and estimating the value of the property, the rates and service are prescribed accordingly.

The Tax Commission. Three men appointed by the Governor constitute the tax commission. It has general supervision over the local assessment of taxes. It is also its duty to assess and levy a tax against transportation and telegraph companies, the greater portion of which is paid into the state treasury. The tax commission also has charge of the assessment and taxation of incomes, assessing corporations directly, and appointing local assessors to assess individuals.

The Fish Commission. This Commission provides hatcheries in different parts of the state where the habits of food fishes are studied. At these hatcheries young fishes are hatched and distributed over the state in waters suited to their habits of life. Fish hatcheries are located at Madison, Oshkosh, Bayfield (E 2), Minocqua (G 5), Delafield (K 14) and Wild Rose (H 11).

The State Board of Forestry. This Board has supervision over the forest reserves located in the northern part of the state, and is trying to introduce modern methods of forest preservation.

Civil Service Commission. Many of the minor offices of the state and the positions of assistants in all the state departments have been placed under "Civil Service" rules. The Civil Service Commission holds examinations for candidates for such positions, and recommends those best fitted for the work. In this way only competent persons are appointed.

The State Board of Control. This board has supervision of state institutions, such as Schools for the Blind and for the Deaf, the Reformatories for Boys and for Girls, the State Asylums for the Insane, and the State Penitentiary.

State Board of Health has general supervision of the health conditions in the state. The Board enforces health regulations in districts where the administrations of local boards are slack. For example, the Board recently issued an order that no general drinking cups shall be provided in public drinking places, as schools, hotels, drinking fountains, railroad stations and trains. This order was issued to prevent the spread of tuberculosis.

The Industrial Commission. The three men appointed on this Commission by the Governor have authority over all employment and places of employment, enforce the laws regarding child labor and the employment of women, school attendance and safety appliances. They conduct free employment agencies, collect information regarding industrial conditions, and hear complaints regarding safety. They endeavor to reach peaceable settlements of disputes between capital and labor.

The Industrial Accident Board has charge of the enforcement of the employers liability law, which provides compensation for injuries received by employees when attending to their duties.

Every two years, the Commissioner of Labor issues The Blue Book of Wisconsin, a volume containing much valuable information about the officers of the state, and of every county in the state.

Besides these, there are other boards and commissions in the state that are rendering valuable service, the principal of which are the State Park Board, the State Conservation Commission, and the State Mining School Board.

INDEX

*Cuts and Maps.

- Ableman, 88, 90.
- Adjustment, Industrial, 96.
- *Agricultural College, State University, 167.
- Agricultural Implements, 125.
- Agricultural Industries, 106.
- Albany, 71.
- Allouez, 157.
- Altitude of Wisconsin, 49.
- Amberg, 88.
- Americans, 91.
- American Occupation, 159.
- Anticyclone, 47.
- *Anticyclone Map, 48.
- Apostle Islands, 148.
- Appleton, 68, 103, 149.
- Archæan Rocks, 21.
- Artesian Wells, 79.
- *Artesian Well, Auroraville, 80.
- *Artesian Well, Prairie du Chien, 79.
- Ashland, 85, 97, 148.
- Asylums for the Insane, 175.
- *Automobile Factory, Kenosha, 145.
- *Automobile Factory, Racine, 149.
- Baraboo, 90, 155.
- Barley, 111.
- Barometer, 44.
- Bayfield, 123, 174.
- Beach, 19.
- Beaver Dam, 71, 117.
- Belgians, 160.
- Beloit, 71, 124, 125, 126, 153.
- Beloit College, 153, 165.
- Belt Line, 132.
- Berlin, 88.
- Black River Falls, 72.
- Black River System, 56.
- *Blast Furnace, 85.
- Blue Book of Wisconsin, 175.
- Board of Control, State, 174.
- Forestry, State, 174.
- State Mining School, 175.
- Park, 175.
- Health, 175.
- Boat Building, 124.
- Boots and Shoes, 124.
- Boundaries of Wisconsin, 10.
- Brick Factories, 90.
- *Brick Yard, 90.
- Brodhead, 71.
- Brokaw, 70.
- *Brule River, 135.
- Building Stones, 87.
- Bureau of Labor and Industrial Statistics, 175.
- *Butter Making by Students, 169.
- *Butter Map, 122.
- *Cabinet Factory, 146.
- Cambrian Rocks, 23.
- Canal, Sturgeon Bay & Lake Michigan, 129.
- Canal, Fox-Wisconsin, 128.
- Canadians, 98.
- *Canning Factory, 117.
- *Canning Factories, 116.
- Carroll College, Waukesha, 165.
- Cattle, 116.
- *Cave in the Sandstone, 15.
- Cedarburg, 72.
- Cedar Dam, 68.
- Cement, Portland, 88.
- Census, State, 175.
- Chain o' Lakes, Waupaca, 36.
- *Chair Factory, 103.
- Cheese Factories, 120.
- *Cheese Making by Students, 170.
- *Cheese Map, 123.
- Cheese Markets, 122.
- Chequamegon Bay, 157.
- Chippewa Falls, 73, 115, 117, 124, 151.
- Chippewa Indians, 156.
- Chippewa System, 56.
- Cities Grow, Why? 137.
- Civil Service Commission, 174.
- Civil War, Effects of, 93.
- Clay, 90.
- Climate of Wisconsin, 49.
- Coal, 29.
- *Coal Dock, 133.
- Coastal Plain, 21.
- Coastal Plain, Lake Superior, 55.
- Colfax, 90.
- College, Beloit, 165.
- Carroll, 165.
- Lawrence, 165.
- Milton, 165.
- Ripon, 165.
- State Agricultural, 166.
- Combined Locks, 68.
- Coming of English, 158.
- Commission, Civil Service, 174.
- Conservation, 175.
- Dairy & Food, 173.
- Fish, 174.
- Interstate Commerce, 132.
- Rate, 174.
- Tax, 174.
- Condensed Milk, 123.
- Continental Shelf, 20, 25.
- Contour Maps, 16, 32, 38, 42.
- Conventions, Farmers, 169.
- Copper, 87.

- Copper Ore, 25.
- Corliss Engine Works, 126.
- Corn, 110.
- *Corn Field, 106.
- *Corn Map, 108.
- Correspondence Work, 170.
- *Cotton Mill, 126.
- County Training Schools, 163.
- *County Training School, Marinette, 164.
- Cranberries, 168.
- *Cranberry Marsh, 107.
- Cranberry Marshes, 110.
- Creameries, 120.
- Cudahy, 117.
- Cyclone, 46.
- *Cyclone Map, 46.
- Dairy and Food Commission, 173.
- Dairy Cattle, 117.
- *Dairy Herd, 93.
- Dairying, 120, 169.
- *Dam at Appleton, 61.
- Danes, 160.
- Darlington, 71.
- Davis Falls, 73.
- Deaf, Schools for, 175.
- Delafield, 174.
- Dells of the Wisconsin, 58.
- De Pere, 68, 157.
- Deposition, 26.
- Development, 69.
- Development of Country by Railroads, 132.
- Development of Power, 65.
- *Devil's Lake, 59, 88.
- Devil's Lake, 155.
- Devonian, 29.
- Devonian Rocks, 23.
- Dew, 45.
- Diamonds, 87.
- Discrimination, 132.
- Distributing Centers, 139.
- Drainage of Wisconsin, 54.
- *Drainage Relief Map, 55.
- Drift, 31.
- Driftless Area, 30, 35.
- *Driftless Area, Contour Map, 39.
- *Driftless Area Scene, 35.
- Drumlines, 37.
- Dunkirk, 71.
- Dunville, 90.
- Dutch, 160.
- Eau Claire, 73, 104, 116, 117, 126, 150.
- Edgerton, 114.
- Electric Cars, 133.
- *Elevator, 131.
- English, 91.
- English, Coming of, 158.
- Erosion, 21.
- Erosion and Deposition, 26.
- Erosion, Early Period, 28.
- Erosion, Later Period, 29.
- Experimental Farms, 168.
- Experimenting with Products, 166.
- Factories, Brick, 90.
- *Factory Correspondence Work, 172.
- Factory Inspection, 175.
- Fair Association, State, 173.
- Fairbank's Machine Works, 126.
- *Farmers Class in Agriculture, 171.
- Farmers Conventions, 169.
- Farms, Experimental, 168.
- Fault Lines, 27.
- *Feeding the Chickens, 121.
- *Field in Northern Wisconsin, 36.
- *Field Work, River Falls Normal, 77.
- Field Work, 14.
- First Land, 25.
- First White Men, 156.
- Fish Commission, 174.
- Fishing, 123.
- *Flock of Wethers, 120.
- Flow, Lava, 25.
- Volcanic, 25.
- Fond du Lac, 103, 104, 106, 111, 148.
- Forest Industries, 101.
- *Forest Map, 99.
- Formation of Ore, 82.
- Fossils, 29.
- Fox River, 62.
- Fox River System, 60.
- Fox-Wisconsin, First Water-way, 157.
- Freight, 127.
- Freight Car Capacity, 131.
- French, 91.
- French Domination, 158.
- Frost, 45.
- Fruits, 107.
- Fruits, Russian, 173.
- Fulton, 71.
- Furniture Making, 104.
- Fur Trade, 91.
- Fur Traders, 156.
- Galesville, 72.
- Germans, 97.
- German Element, 160.
- Glaciated Region, Solis, 37.
- *Glacial Drift, Contour Map, 42.
- *Glacial Drift Map, 54.
- Glacial Effects, 30.
- *Glacial Relief Map of Wisconsin, 33.
- *Glacier, 32.
- Glaciers, Ancient, 31.
- Glaciers, Effect of, 36.
- Glaciers in Wisconsin, 33, 36.
- Glaciers of the Present, 31.
- Gildeden, 103.
- *Giant's Grotto, 22.
- Goats, 120.
- Gold, 87.
- Good Water, 81.
- Graded Schools, 161.
- Grand Rapids, 70, 90.
- Grand Rapids Falls, 72.
- Granite Area, 26, 87, 89.
- Granite Industry, 87.
- Granite Paving Block Industry, 88.
- Granite Quarries for Paving Blocks, 88.
- Graphite, 87.

- Great Lakes, 88, 133.
 Great Lakes, Effect, 50.
 Great Lakes, Formation, 38.
 *Great Lake Maps, 41.
 Green Bay, 90, 94, 123, 149.
 Green Bay Basin, 62.
 Grist Mill, 64.
 Ground Water, 78.

 *Harvesting Oats, 110.
 Hatfield, 72.
 Hay, 111.
 *Hay Map, 112.
 High Falls, 72.
 High Schools, 161.
 Hogs, 116.
 *Hog Map, 118.
 Home Geography, 13.
 *Horticultural Grounds, State
 University, 95.
 Hudson, 73.
 Hudson Bay, 32, 33.
 Hurley, 154.
 Huronian Rocks, 22.
 Huronian Sandstone, 25.

 Ice Sheet, 33.
 Immigration, 97.
 Implements, Agricultural, 125.
 Indians, Chippewas, 156.
 Indians, Winnebagoes, 156.
 Industrial Adjustment, 96.
 Industrial Schools, 165.
 Industries of Wisconsin, 99.
 Injurious Insects and Plants, 168.
 Instructors sent from University,
 170.
 Inspection, Factory, 175.
 Interstate Commerce Commission,
 182.
 *Interstate Park, 57.
 Interstate Park, 56.
 Interurbans, 133.
 Iron Deposits, 82, 83.
 *Iron Mine, 84.
 Iron Mining, 84.
 Iron Ore, 25.
 Iron Smelting, 85.
 Isle Wisconsin, 26.
 Isobar, 45.
 Isotherm, 44.

 Janesville, 71, 114, 115, 116,
 124, 125, 153.
 Jefferson, 71, 117.
 *Jersey Cows, 118.
 Johnson Falls, 72.

 Kames, 37.
 Kaukauna, 68, 149.
 Kenosha, 90, 104, 106, 120, 130,
 139, 144.
 Keweenaw Rocks, 22, 25.
 Kilbourn City, 70, 143.
 *Kilbourn Dam, 65.
 Kindergarten, 161.
 Knitting Factories, 120.
 *Knitting Factory, 144.

 LaCrosse, 88, 97, 110, 111, 123,
 125, 151.
 Land Masses, Effect, 49.
 Land Transportation, 127.
 Ladysmith, 73.
 Lakes, 38.
 Lakes as Reservoirs, 65.
 *Lakes Duluth & Chicago, 40.
 *Lakes Algonquin & Iroquois, 40.
 Lakes Formed, 36.
 Lake Michigan, River Systems,
 62.
 Lake Superior, Basin, 27.
 Lake Superior, Coastal Plain, 55,
 89.
 Lannon, 88.
 La Pointe, 157.
 Latitude of Wisconsin, 49.
 *Launching Freight Boat, 147.
 Lava Flows, 25.
 Lawrence College, Appleton, 165.
 Lead, 87.
 Lead Deposits, 86.
 Lead Mines, 91.
 Leverett, Mr. Frank, 43.
 Lime Industry, 88.
 Limestone Industry, 88.
 Limestone Period, Magnesian, 28.
 Silurian, 29.
 Little Chute, 68.
 *Little Chute Dam, 68.
 *Little Kaukauna Dam, 69.
 Little Quinnesec, 72.
 Live Stock Industries, 116.
 *Load of Logs, 101.
 *Logging, 100.
 Location of Cities, 137.
 Location of Wisconsin, 10.
 Lumber Industry, 94.
 Lumber Industry, Effect of, 96.
 Lumbering, Roads, 128.

 Machinery, 126.
 Madison, 114, 115, 125, 126, 152,
 174.
 Magnesian Limestone, 28.
 *Main Hall, State University, 162.
 Manitowoc, 90, 111, 116, 120, 145.
 Manufacturing, 65.
 Marinette, 72, 88, 115, 145.
 Marquette University, Milwaukee,
 165.
 Map Drawing, 15.
 Maps, Contour, 16.
 Mayville, 71, 155.
 Mellen, 106.
 Menasha, 68, 149.
 Menominee, 73, 90.
 Merrill, 70, 106, 150.
 Milk, 122.
 Milk, Condensed, 123.
 Milton College, 165.
 Milwaukee, 85, 89, 90, 92, 96, 103,
 106, 111, 117, 120, 122, 123,
 124, 125, 126, 137, 141.
 Milwaukee-Downer College, Mil-
 waukee, 165.
 *Milwaukee Harbor Map, 139.
 *Milwaukee Harbor View, 141.
 *Mineral Map, 83.

- Mineral Point, 154.
- Mining, Iron, 84.
 - Lead, 86.
 - Zinc, 86.
- Mining School Board, State, 175.
- Mines and Minerals of Wisconsin, 82.
- Minocqua, 174.
- Missionaries, First, 157.
- Mississippi River, 59, 130.
- *Mississippi River, 60.
- Models, 16.
- Moisture, 45.
- Monadnocks, 28.
- Monroe, 123.
- Montello, 88.
- Moraine, Terminal, 35.
- Nekoosa, 70.
- *Nekoosa Dam, 71.
- Natural History Survey, 171.
- Neenah, 68, 149.
- New Richmond, 73.
- Normal School, 154.
- Normal School System, 163.
- North Western University, 154, 165.
- Oats, 111.
- *Oats Map, 109.
- Oconto Falls, 72.
- Old Land, 26.
- *Old State Capitol, 157.
- Ordovician Rocks, 23, 28.
- *Ore Dock, 134.
- Ores, Their Formation, 82.
- Oshkosh, 103, 104, 124, 126, 148, 174.
- *Packing House, 119.
- Packing Houses, 117.
- Park Falls, 73.
- Park, Interstate, 56.
- Paper Making, 104.
- *Paper Mill, 70.
- Passengers, 131.
- *Pearl Fishing, 124.
- Pearl Fishing, 123.
- Peat, 90.
- Pebbles, 88.
- Penitentiary, State, 175.
- Peshtigo, 72.
- Pioneer, 91.
- Platteville, 154.
- Plain, Coastal, 21.
- Planing Mills, 102.
- Poles, 160.
- Portage, 153.
- *Portage, Contour Map of Region, 17.
- Port Edwards, 70.
- Port Wing, 90.
- Potatoes, 115.
- *Potato Map, 116.
- Potsdam Sandstone, 23, 77, 80, 89.
- Poultry & Eggs, 120.
- *Poultry Map, 121.
- Power, Its Development, 65.
- Prairie du Chien, 123, 153.
- Prairie du Sac, 70.
- Principal Industrial Centers, 137.
- *Public Library, Milwaukee, 138.
- Pure Seeds, 166.
- Quarries, 88.
- Racine, 88, 90, 97, 123, 124, 125, 126, 139, 143.
- Railroads, 130.
- Railroad Building, 93, 130.
- Railroads Develop a Country, 132.
- Railroad, First, 93.
- Railroad Terminals, 131.
- Railroads, Work of the, 130.
- Railroad, Chicago & North-Western, 93.
- Railroad, Milwaukee & St. Paul, 93.
- Rain, 47.
- Rainfall, 45, 51.
- *Rainfall Map, 51.
- Rambler Automobile Factory, 126.
- Rate Commission, 174.
- Red Granite, 88.
- Reference Books, 16.
- Reformatories for Boys and Girls, 175.
- *Relief Map of Wisconsin, 26.
- Reservoirs, 69.
- Reservoirs, Lakes, 65.
- Rhineland, 70, 150.
- *Rib Hill, 28.
- Ripon, 120.
- Ripon College, 165.
- Rivers, Black, 56.
- Bois Brule, 55.
- Chippewa, 56.
- Fox, 59.
- Fox, upper, 60.
- Fox, lower, 61.
- La Crosse, 58.
- Manitowoc, 63.
- Menominee, 62.
- Milwaukee, 63.
- Mississippi, 58.
- Nemadji, 55.
- Oconto, 62.
- Peshtigo, 62.
- Rock, 60.
- Root, 63.
- Sheboygan, 63.
- St. Croix, 56.
- St. Louis, 55, 74.
- Trempealeau, 58.
- White, 55.
- Wisconsin, 58.
- Wolf, 61.
- Roads, 127.
- Roads for Lumbering, 128.
- Rocks, Archaean, 21.
- Cambrian, 23.
- Carboniferous, 24.
- Cretaceous, 24.
- Devonian, 23.
- Huronian, 23.
- Keweenaw, 22, 25.
- Ordovician, 23, 28.
- Quaternary, 24.
- Sedimentary, 21.
- Silurian, 26.
- Tertiary, 24.

- Rock River System, 60.
 *Rubber Goods Factory, 151.
 Rural Schools, 161.
 Russians, 160.
 Russian Fruits, Imported, 173.
 Rye, 110.
 *Rye Map, 109.
 Sandstone, Potsdam, 23, 80, 89.
 Huronian, 25.
 Sandstone Quarries, 90.
 *Saw Mill, 102.
 Saw Mills, 102.
 Scandinavia, 97.
 Scandinavians, 160.
 *Scene in Glaciated Region, 38.
 Schools, 161.
 *School Garden, 14.
 Schools for the Deaf & Blind, 165.
 Sedimentary Rocks, 21.
 Seeds, pure, 166.
 Sheboygan, 90, 103, 104, 116, 120,
 122, 123, 124, 125, 144.
 Sheboygan Falls, 72, 120, 145.
 Sheep, 117.
 *Shoe Factory, 125.
 Silurian Limestone, 29.
 Silurian Rocks, 23, 29.
 Snow, 45.
 Society, State Historical, 171.
 State Horticultural, 172.
 Soil, 75, 168.
 *Soil Map, 76.
 Soils, Alluvial, 75.
 Soils, Glacial, 75.
 Soils, Limestone, 77.
 Soils in Glaciated Regions, 37.
 Soils and Ground Water, 75.
 Soil, Sandy, 76.
 Soldiers' Grove, 114.
 South Centralia, 70.
 Sparta, 116, 152.
 Springs, 78.
 Stage Coach, 127.
 State Agricultural College, 166.
 State Board of Control, 174.
 State Board of Health, 175.
 State Board of Forestry, 174.
 State Capitol, 152.
 *State Capitol, Frontispiece.
 State Census, 175.
 State Conservation Commission,
 175.
 State Education, 161.
 State Fair Association, 173.
 State Growth, 160.
 State Historical Society, 171.
 State Horticultural Society, 172.
 State Mining School Board, 175.
 State Park Board, 170.
 State Penitentiary, 175.
 State Reformatory, 165.
 State School of Mines, 154.
 State Superintendent, 165.
 State University, 152, 164, 170.
 St. Croix Falls, 73.
 St. Croix System, 56.
 Stevens Point, 70, 152.
 *Stock Yards, 129.
 Stones for Building, 87.
 *Storm on Lake Superior, 20.
 Storms, Smaller, 48.
 Stoughton, 114.
 *Stove Factory, 142.
 *Stream Showing Effects Glacia-
 tion, 37.
 Sturgeon Bay, 88.
 Sturgeon Bay & Lake Michigan
 Canal, 129.
 Sugar Beets, 114.
 *Sugar Beet Field, 115.
 *Sugar Beet Map, 114.
 Summer Resorts, 135.
 Superior, 104, 110, 124, 126, 145,
 146.
 *Superior Harbor, 27.
 *Superior Harbor Map, 140.
 Swedes, 97.
 Synclinal Trough, 27.
 Tanning, 105.
 *Tannery, 105.
 Tax Commission, 174.
 Teachers, 163.
 Temperature, 50.
 *Temperature Map, 52.
 Terminal Moraine, 35.
 *Terminal Moraine Map, 34.
 Terminals, Railroad, 131.
 Tertiary Period, 27.
 Thermograph, 44.
 Thermometer, 44.
 Thiensville, 72.
 *Threshing Wheat, 111.
 Tobacco, 96, 113, 168.
 *Tobacco Field, 113.
 *Tobacco Map, 112.
 Tomahawk, 70.
 Topography in Railroad Building,
 130.
 Tornado, 46.
 Traders, Fur, 156.
 Train, 131.
 Training School, County, 163.
 Transportation, 127.
 *Transportation Map, 128.
 Transportation, Lake, 134.
 Trial Orchards, 173.
 Trough Synclinal, 27.
 University, 161, 164.
 University, Northwestern, 154,
 165.
 Marquette, 165.
 Milwaukee—Downer, 165.
 State, 152.
 Instructors from, 170.
 Vapor, 45.
 Vegetables, 115.
 Veneer, 103.
 Viroqua, 114.
 Volcanic Flow, 25.
 Volcanoes, 19.
 Waldo, 72.
 *Wagon Factory, 143.
 Wash, 36.
 Washburn, 90, 157.
 Water, Good, 81.
 Water Power of Wisconsin, 64.
 *Water Power Map, Developed, 66.